Vol XXI, No. 1
FEBRUARY 1954

THE SCIENCE TEACHER

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- Bring the Sky Into the Classroom
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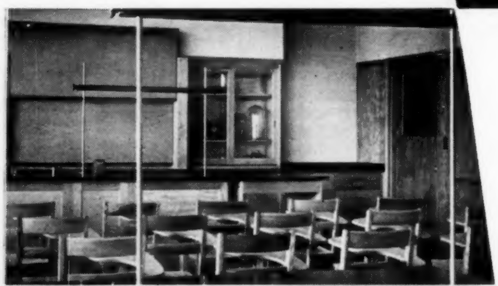
JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION



THE SCIENCE TEACHER

Volume XXI

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THE NATIONAL SCIENCE TEACHERS ASSOCIATION

A Department of the National Education Association

1201 Sixteenth Street, N. W., Washington 6, D. C.

THIS MONTH'S COVER . . . pictures a familiar scene to student winners, science teacher sponsors, and NSTA and ASM representatives, all of whom had a part in the 1953 program of Science Achievement Awards. October 9, 1953 was the day for presentation of awards at Haven Junior High School, Evanston, Illinois. Three students won U. S. Savings Bonds and five others received honorable mention. NSTA is proud to add recognition in this way to all who participated in these programs and they're interested in looking in on similar scenes in 1954. The closing date for student entries is May 15.

Readers' Column

I should like to renew my membership in NSTA, but as a sustaining member this time. I should also like to have a copy of *Science Instruction 1953*, the report of the Pittsburgh convention. It is a pleasure to say that as time goes on I seem to find my NSTA membership getting more valuable. . . . "Time doth not wither nor custom fade your infinite variety," indeed.

BURNETT CROSS
New York City

THE SCIENCE TEACHER is the finest publication of its kind in the U. S. For the usual reasons I don't manage to get too far from my teaching assignment so I depend on it for inspiration, information, and courage! *Our* splendid periodical takes me into other school systems, lets me visit with other science teachers and compare mutual problems, and above all, it challenges me to do better teaching daily. I use THE SCIENCE TEACHER extensively in my secondary science teacher training program.

Let me know if I can be of assistance "out Kansas way."

DON Q. MILLIKEN
Pittsburg, Kansas

I have just received my copy of "Selected Science Teaching Ideas of 1952." I have not had time to read every word but I have read some of the reports and looked over the remainder. It is one of the best publications I have seen and I just wanted to say congratulations.

RUTH E. CORNELL
Wilmington, Delaware

I want to acknowledge receipt of your new publication, "Selected Science Teaching Ideas of 1952." The effort of your Association in making this booklet available is most commendable. Without doubt it is a most outstanding contribution to the cause of education and the service which members of the teaching profession can render to each other.

J. W. CHISHOLM
District Superintendent
Mineola, New York

Enclosed find 2 money orders for $106.00 plus 1 check for $4.00. This represents the membership fees I collected at this year's New York State Teachers Association meeting (western zone). My supply of membership promotion material is now depleted and I would appreciate more; especially the ELEMENTARY SCHOOL SCIENCE BULLETIN since I plan to send notices to all elementary schools in the area and I would like to include copies in the mailing.

JOSEPH P. SPINA
Williamsville, New York

As a subscriber to your services for elementary science, I suggest that a mimeograph list of "things to do" in teaching and learning about aviation in the primary grades be made available. This would constitute an excellent project. In addition, I wish to express my complete satisfaction and delight with your ELEMENTARY SCHOOL SCIENCE BULLETIN. It is an invaluable aid to elementary school teachers.

SISTER M. FRANCIS REGIS, C.S.J.
Brighton, Massachusetts

(Editor's Note: It's most encouraging to us at headquarters to receive reports on projects completed as the following.)

I was away from 11/19 to 11/30 during which time arrived (1) Jets (2) Look to the Sky (3) Packet XXVI (4) November journal! ! ! Good Going.

East Orange reporting receipt today of "*Cellulose: The Chemical That Grows*", a 386 page volume. Thank you for continuing to make the NSTA dollar worth more than 100 cents, a phenomenon in the U.S.A. today.

NATHAN A. NEAL
East Orange, New Jersey

THE SCIENCE TEACHER

The Journal of the National Science Teachers Association, published by the Association, 1201 Sixteenth Street, N. W., Washington 6, D. C. Membership dues, including publications and services, $4 regular; $6 sustaining; $2 student (of each, $1.50 is for Journal subscription). Single copies, 50¢. Published in February, March, April, September, October, and November. Editorial and Executive Offices, 1201 Sixteenth Street, N. W., Washington 6, D. C. Copyright, 1953, by the National Science Teachers Association. Entered as second-class matter at the Post Office at Washington, D. C., under the Act of March 3, 1879. Acceptance for mailing at Special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph (d), Section 34.40 P. L. & R. of 1948.

MEMBERSHIP

The membership year coincides with the calendar year. New entries during the fall months extend through the following calendar year. Library and elementary school subscriptions coincide with the school year or run for one year from date of entry.

Active Membership	$4.00
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Elementary School Subscription*	$5.00
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(payable in annual installments of $10.00)

* Includes the *Elementary School Science Bulletin* in quantity lots.

Coming . . .

in the March issue of *The Science Teacher*

- Color Television—A Summary for Teachers
- Reading and Plugging In—Through Elementary Science
- Hydroponics
- What Should High School Science Do?

Editor's Column

Cooperation from the ground up and with a nation-wide influence has been beautifully demonstrated in the production and distribution of *Selected Science Teaching Ideas of 1952*. All NSTA members will be interested and proud to hear the story, I am sure.

It began when about sixty teachers submitted essays in the 1952 program of Recognition Awards for Science Teachers, sponsored by the American Society for Metals. Later these entries were submitted to editorial review by Dr. R. Will Burnett of the University of Illinois. He came up with thirteen selections, plus two from other sources, for publication. Encouraged by a special grant of $1000 from ASM, the Association spared no efforts to produce an outstanding volume—as evidenced by the number and quality of engravings and the quality of the printing. The initial printing was 2000 copies, but it was recognized that this number would not go far in achieving the goal of *widespread* dissemination of good science teaching ideas—and NSTA could not "go it alone."

With type standing and mailing lists ready, a number of professional scientific and engineering societies were invited to share in the project. The American Chemical Society purchased $600 worth of books and grants were made by the following groups in the amounts indicated: American Association for the Advancement of Science, $300; American Society for Testing Materials, $300; American Institute of Physics, $600; and the Engineering Manpower Commission of Engineers Joint Council, $1000. These sums, plus a small amount of "risk capital" by NSTA, enabled us to go to print again, this time for 10,000 copies.

Free distribution to date adds up as follows: about 800 copies to NSTA Life and Sustaining members; about 8000 copies to city and county superintendents of schools all over the country; about 600 copies to the science education departments of colleges and universities. We have sold about 500 copies, many of which have been ordered by school superintendents in quantity—seven, 13, 16, 27 copies—for distribution to the science teachers in their school systems, a most heartening result. As of today, then, we have close to 10,000 copies of *SSTI 1952* at work throughout the country; we have about 1800 copies in stock; and we need to recover only $600 in sales in order to break even on the total venture. Not bad! Makes us all feel mighty good, like we've done our Boy Scout deed for the day.

Robert H. Carleton

THE SCIENCE TEACHER

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Articles published in THE SCIENCE TEACHER are the expressions of the writers. They are not a statement of policy of the Association or the Magazine Advisory Board.

The National Science Teachers Association is a department of the National Education Association and an affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction and later expanded as the American Council of Science Teachers, it merged with the American Science Teachers Association and reorganized in 1944 to form the present Association.

Venereal Disease—

▶ ▶ ▶ DOWN BUT NOT OUT

T. LEFOY RICHMAN

Health Program Officer U. S. Public Health Service

THIS is a message to teachers. Every day in the school year the teachers in American high schools and the instructors in the first two years of college give personal instructions to some eight million young men and women. To a great extent their world and their futures in the world are shaped during those years by those teachers.

One of the brave promises held out to young people a decade ago was that of a world free from venereal disease. Penicillin had been discovered. It had been applied to syphilis with startling success. The press proclaimed it a miracle drug, and it was reasoned that this miracle drug, if it measured up to its promise, would soon free mankind from syphilis and gonorrhea. The drug is still marvelously potent. And there is now a feeling, amounting to almost a conviction, that penicillin *has* eliminated syphilis from among the modern disease hazards. If this were true, it would be cause for jubilation—another victory for the age of science, another advance in man's struggle against disability and premature death.

The feeling that venereal disease is no longer a problem has been fortified during the past ten years by public pronouncements of the rapid cure of both syphilis and gonorrhea by penicillin, by the rapid decline in the number of early cases of syphilis treated, and more recently by announcements that the scarcity of venereal disease patients in university clinics soon will result in doctors' learning about venereal disease from pictures and books only.

These are persuasive arguments for the position that venereal disease is down for the long count. But before we leave our seats for the exits, it may pay us (particularly those of us who teach) to take a more careful look at the fighters and the arena. First of all venereal disease, the fighter supposedly about to be counted out, is not one but several fighters. Under this convenient label are lumped syphilis, gonorrhea, chancroid, lymphogranuloma venereum, granuloma inguinale, pinta, and yaws. These are all venereal diseases. Four of them, syphilis, gonorrhea, chancroid, and granuloma inguinale, have long been serious problems in the United States. Only two of these four, syphilis and gonorrhea, respond to penicillin. Only one of the two, syphilis, shows a satisfactory decline in the annual rate of reported early cases. In fiscal year 1947 physicians and clinics reported some 106 thousand cases of primary and secondary syphilis in the continental United States. In 1953 they reported under ten thousand. Since we have no reason to believe that reporting is better or worse in 1953 than it was in 1947, we conclude that this represents a declining trend in the attack rate of syphilis in the United States.

However, early syphilis doesn't kill or disable. It does little immediate harm, and its early signs and symptoms may be so slight as to go unnoticed. Untreated, the syphilis spirochete may lie dormant in the human body for years before becoming active. Afterwards, in the late active stage, syphilis does kill and disable. The Public Health Service estimates that some *two million persons* in the United States now have syphilis requiring treatment. The bulk of these are in the latent stages of the disease. Perhaps half of them do not know they were ever infected. Many of the other half had inadequate treatment in the past, and think they are now free of the disease. These two million persons are candidates for mental institutions, wheel chairs, crutches, seeing-eye dogs, and early graves. If they are found and given penicillin treatment in time, the progress of their disease may be stopped. Even penicillin, however, cannot repair the tissue damage already done.

Thus, although early syphilis morbidity has declined dramatically since 1946, the victims of latent and late syphilis are still with us in alarming numbers, and a vast human conservation job still re-

mains to be done before we may count syphilis down and out.

Gonorrhea responds much more rapidly to penicillin than does syphilis, and smaller dosages are required. A single injection of only 300 thousand oxford units of penicillin will cure all but a very few cases of gonorrhea. Nevertheless gonorrhea rates have not yet begun to show a decline comparable to that of early syphilis. In 1947 physicians and clinics reported over 400 thousand cases of gonorrhea in the continental United States. In 1953 they reported almost 244 thousand. This is still a sizable volume of dangerous, infectious disease in the population. Gonorrhea cripples, sterilizes, and causes blindness.

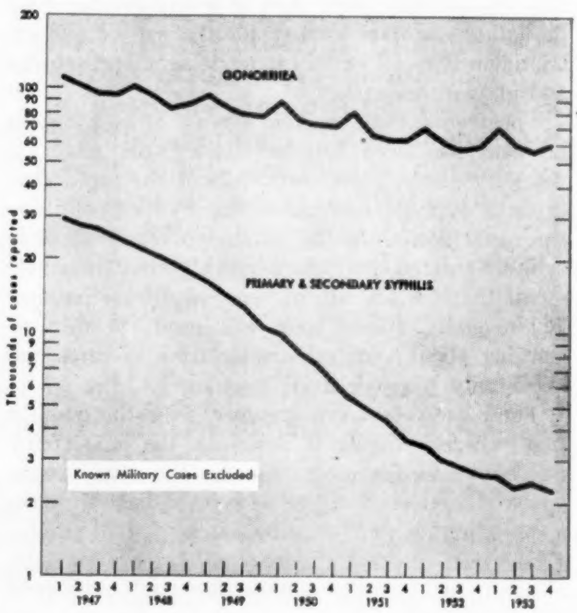
The slow decline in the gonorrhea rates are of special significance in considering the "down and out" status of venereal disease in the United States. Gonorrhea is easy to cure with small dosages of penicillin, and the accepted dosage of 300,000 units represents the per capita volume of penicillin distributed in the United States last year for VD, for sore throat, the common cold, pneumonia, and a wide variety of internal and external infections. It has been assumed, therefore, that, without any special effort on the part of public health officials or doctors, penicillin would eventually eliminate gonorrhea.

The persistent high morbidity rate of gonorrhea seems to repudiate this assumption and invites explanation. One explanation frequently heard is that the rates are maintained at a fairly high level by repeaters; that is, people who become infected many times in the course of a year. The rates may indicate the number of treatments given for gonorrhea rather than the number of persons infected. This would explain the phenomenon only in part. While the repeater does exist, he is an exception rather than the rule, and he could not alone account for the wide disparity between the rates of early syphilis and gonorrhea. Another explanation, and one more widely accepted, is that gonorrhea rates remain high because there has been no concerted effort to find gonorrhea victims and bring them to treatment as has been the case with those having early syphilis.

The rapid decline in morbidity rates in early syphilis reflects the energy and efficiency with which the syphilis casefinding apparatus has been developed and put to work. Only in a few large cities and within the past eighteen months, have similar efforts been made to find and treat gonorrhea. In those scattered attempts one sees now real promise of success.

This brings us to the nature of the fight against VD, and suggests that we now look more closely at the arena. The United States' struggle against venereal disease is essentially a search. It can be illustrated most easily in terms of syphilis control. Although the spirochete which causes syphilis may announce its presence to its victims, many of its victims are likely to be more discreet. People with syphilis are frequently loathe to reveal the nature of their infection, even to doctors. Some are unaware that they are infected, and a few don't care. We are therefore seeking some two million syphilis victims—some reluctant, some ignorant, some indifferent—in a community of 150-odd million persons, spread out across the entire area of the United States. Moreover, the people we seek are likely to be among the most mobile in the population. For that reason the search is not one which can be carried on by health officials in any single city or county or State. It requires a nation-wide network of communication, diagnostic facilities, and treatment centers. Implementing these services, there must also be the investigators who track down possible infections from known sources. And there must be the education effort which creates, by keeping the public alert to the danger of venereal infection, an environment within which VD control work may be done successfully. It is a little like looking for a needle in a haystack, except that the needle is a stationary object with no concern about being found, and the haystack is confined to a single small area.

REPORTED CASES OF PRIMARY AND SECONDARY SYPHILIS AND GONORRHEA
CONTINENTAL U.S., BY FISCAL QUARTERS 1947 - 1953



In our struggle against both syphilis and gonorrhea, education, elusive as always to evaluate, has been a most productive part of the control effort. Primarily this flows from the nature of the control effort itself. There have been, for all to see and question, blood testing teams on street corners and in industrial plants, on large farms and plantations, in schools and other public facilities. This testing has occasioned talk from person to person, comment in the public press, on television, on radio, and, to a lesser degree, instruction in the classroom. There have been huge signs on billboards and in lights advising that penicillin cures VD and urging, "go to a doctor or a clinic for a check-up."

As the venereal diseases gradually are brought under control by the direct methods of finding and treating, the efforts in VD education require more careful direction and more fundamental concern with the problem of prevention. Education, like woman's work, is never done. There is always an on-coming generation to be equipped for living in what rapidly becomes "its world." And there is always an older generation to be brought up-to-date on its rapidly changing environment.

Teachers, particularly science teachers, have long been alert to their VD education responsibilities. It is only in the past few years, however, that they have been able to draw upon a body of solid fact for their teaching material. Only recently have they been able to state with assurance that no one need get venereal disease and that no one who has it need keep it. That teachers may now make these statements to their students with assurance and candor is the most hopeful single prognosis for the complete and ultimate control of venereal disease. For medical science has been able to develop no immunizing agent against syphilis or gonorrhea. This is perhaps the first time in medical history that epidemiologists have been able to speak hopefully about the control of a disease for which no immunizing agent exists.

Unfortunately the apparent success of the case-finding and treatment effort seems now to have militated against the long-term gains already achieved and the hoped-for ultimate eradication of syphilis and gonorrhea in the United States. Taking their cue from the public pronouncements of the efficacy of penicillin, legislators, public officials, and even doctors have begun to withdraw their support from venereal disease control. That this withdrawal of support may be premature, even though other unsolved disease problems are clamoring for attention and support, is the critical public health question of the moment. Even as the question is being debated in terms of slimming budgets and new dramatic scientific worlds to conquer, sporadic epidemics of syphilis remind us of the precarious nature of our present gains. A few months ago in West Point, Georgia, population 4300, a particularly violent outbreak of syphilis was arrested by prompt investigation of the contacts of a single person whose blood was found to be positive in a selective service examination. Within a matter of weeks these investigations produced sixty cases of previously untreated primary and secondary syphilis, four cases of early latent syphilis, and led to the discovery of one case of late latent syphilis, and one case of congenital syphilis. Almost all the patients were young people, 16 to 25 years of age.

U. S. PUBLIC HEALTH SERVICE, DIVISION OF VENEREAL DISEASE

Bloodtesting on the sidewalks of New York generates useful talk, finds hidden syphilis.

Were it possible to immunize against syphilis, the epidemic at West Point, Georgia might not be taken too seriously. For Georgia is a State in which venereal disease control efforts have been carried on for some years with remarkable success. State officials there, at first shocked by the epidemic, are gravely concerned now that it may be the forerunner of very serious problems to come. They see their present control resources rapidly disintegrating before the combined onslaught of superficial economy and a false sense of security. They realize that they could handle the West Point, Georgia, problem only because their control team, though reduced in numbers, is still intact. The official Georgia report of the West Point story contains the following pointed statement: "We feel that if this could happen to us in a six-week period of time, in

(Please continue on page 29)

PROGRESS IN MAKING SCIENCE REAL TO EVERYONE

By W. BAYARD BUCKHAM

Course construction and curriculum development are chores that go on endlessly in the profession in which we are engaged. We're never satisfied with what we've got; we can't be, for the moment we begin to stand still we begin to slip backward. And throughout the history of science teaching, one of the goals zealously sought after has been that of making science more "practical," or more "functional," to everyone. After all, teachers of science want science to *mean* something to their students; they want their instruction to produce an impact.

In a talk before the Northern Section of the California Science Teachers Association, Mr. Buckham sketched some highlights in progress toward this goal and offered suggestions to take us on from where we are today. It seems likely that this article will be helpful to others who are engaged in the evaluation and revision of their science programs.

A native of New Hampshire, Mr. Buckham is a teacher of more than thirty years experience; is head of the science department in the Oakland, California, high school. He has been active in NSTA affairs, having served on the Board of Directors and just completed a term as Western Regional Vice-President.

TWO years ago we as science teachers should have staged a bicentennial celebration. The year 1951 marked the two-hundredth anniversary of the beginning of science teaching in this country. It was started by Benjamin Franklin in 1751 at the Philadelphia Academy. Interestingly enough the aim of science teaching in those early days was to have young people read "the histories of nature" for descriptive, utilitarian (I wish to emphasize the utilitarian), and religious purposes.

Thus science in general education, or science for the interpretation of daily life, had its start many years ago. However its growth was interrupted rather rudely by the intrusion of the idea that the purpose of education was to train the mind. The memorizing of factual materials, the working of problems selected for their difficulty and practice in abstract reasoning, resulted in the formation of a chasm between science as taught and science as needed for daily life.

Into the high schools organized for training the mind and preparation for college poured the masses. This began about 1910 and continued almost to the start of the recent war when it was checked by the need for youth in industry. Upon returning to school after the war they found science dry and uninteresting and so these non-academic students steered clear of it. Chemistry and physics have survived because of their college entrance value. General science in the Junior High School, fused biological and physical science courses in the Senior High School and Junior College have developed to meet the needs of the masses. Such courses have grown out of the modern conception that the school is for the purpose of meeting the life needs of children and youth.

As for the time and place for present science courses the Cooperative Committee on Science Teaching of the AAAS [1] has recommended one year of general science, possibly in the seventh or eighth grade, one year of biological science, and one year of physical science. The latter may be physics or chemistry or a fused physical science course. They go on to say that the high school curriculum needs a thorough reorganization and the equipment needs modernizing. I say that for non-reading, non-studious boys in particular, a physical science course could be built around gadgets that run. They say science should be taught by means of first-hand experiences with natural phenomena gained from demonstrations, field trips, and laboratory experiments. I say this is true, but use the demonstration to show the students how and why and the laboratory to follow up with real experiences in the use of that which was demonstrated. Real experiences require real things to work with and not precision or toy equipment. Test tubes are real to any chemistry laboratory, but the wheel and axle in physics does not look like the steering wheel of an automobile.

It is easy to name courses and place them at certain grade levels, but the test of their realness lies in their effect on the students. If we examine present trends we find that educators in their en-

[1] Report No. 4. *"The Preparation of High School Science and Mathematics Teachers."* AAAS Cooperative Committee. *School Science and Mathematics*, Feb. 1946.

deavor to meet the needs of young people in science are organizing the science content from several different points of view. Which is correct only time and experimentation can tell. We should stop to examine each briefly in order to round out our picture of progress.

First let us digress a minute and consider the training of the specialists. Perhaps the tremendous advance in pure and applied science is proof of the fact that we are doing a good job here. The late Franklin Delano Roosevelt said that he, as president, nearly always could find one or more competent specialists to tackle any particular part of a program, but what he sought for continually and could seldom find, was a generalist, one who could see how this and that and the other fitted together. Classes in chemistry and physics could really go to town if they were rid of those who have to take these subjects to meet a general college entrance requirement. Why not make science real to these general college students by creating a year of college preparatory physical science? It might be composed of those parts of astronomy, physical geography, chemistry, and physics which bring about the understandings useful in daily life. Will the universities allow us to do this?

Returning to science in general education, there are those who attack the problem from the angle of the broad fields or survey course. Such courses are set up by an analysis of the content of the courses to be fused. The advocates of this plan assume that (1) teachers can accurately predict the knowledge needs of students. (After all teachers live, and by pooling their experiences should be able to arrive at the points of contact between science and living. They know both. Expert opinion is important in any field.) (2) Enough motivation can be supplied to bring about efficient learning. (Self motivation, outside of a person's special interests, seems to be rare. The science teacher should be as able as anyone to capitalize on curiosity about nature.) (3) Facts, principles, and concepts will be retained until needed. (Retention could be increased by means of a planned science program extending from the elementary school through the Junior College. Such a course might be a spiral of expanding science concepts.)

Next there are those who seek to make science real by attaching it to social needs. This is called the social demands approach. Water supply is an essential community need. Therefore it is assumed that to show how the principles of liquid pressure are used to supply water, meaning will be given to these principles. In their turn, meaning and interest will result in better retention. From the water supply one can go on to electricity since it is a by-product of water storage. Individuals use water and so the chemical nature of water can be tacked on. If one is not careful all of this may become like a string of tacks hanging head to point from a magnet. The first tack, like the first principles of water pressure, cling firmly to the fundamental. From this point on the pull of the magnet becomes weaker, as does the attachment of the other scientific principles to the water supply. Why go way around by the city reservoir? Let's make a direct attack; i.e., How can I control the force of water so that it will work for me? How can I maintain the correct electric current for safety? How can I make the best use of water?

There is still another group that advocates the establishment of a core course which fuses all subjects around areas of human activity, problems of life, and the adolescent. Here science as such loses its identity and the science teacher is called in to lend his assistance when scientific knowledge is needed. Since the core course does not occupy the full day and science and other subjects are taught as such for those interested, there may be much of value in this, particularly in the junior high school.

Then there are those who advocate that science is method. They say the principal objective of all science classes is to teach how to solve problems by the scientific method. Subject matter is merely a means to an end. A knowledge of the sources of information and the techniques of using it are all that is important. They hold that complete coverage of all facts is impossible.

This last statement reminds me of a remark made recently by a student in my evening chemistry class.

He said, "Now I know why kids don't know anything when they get out of school. There is so much to learn and you teachers go so fast to cover the ground, that no one can learn anything thoroughly."

This problem of the overload of subject matter in all courses is one that needs attention. Dr. Malcolm McLean of the University of California at Los Angeles has described this situation as follows: "Our curricula grow like cancers by a process of cell division, with little or no power of elimination. . . . In education, as in the physical world, any action sets up an opposing reaction. The fact and powerful action, that of dividing and splitting and adding to the curriculum, I have briefly described. The reaction to it, growing stronger from year to year, is the movement we call general education. Essentially it is an attempt at synthesis."

If the problem of the curriculum for general education is essentially one of synthesis, how can it be

met in science? One must synthesize around something. A quick review of the literature seems to emphasize synthesis about science understandings. In an article entitled "The Measurement of Understanding in Science" in the 45th Yearbook of the National Society for the Study of Education, I found this definition of an understanding: "Understanding is used to denote a major conception so grasped as to illuminate its connections with related conceptions and to result in significant changes in the individuals behavior." In fact there are said to be two kinds of understandings for science, those that concern matter, energy, or organisms and those that concern the methods of science.

As I write these words I cannot help but contrast this somewhat nebulous idea with the concrete examples of factual science taught by the armed forces during the recent war. And this was met by rapid efficient learning on the part of some of our poorer students in the schools. Certainly subject matter applied as a means to an end is the best road to efficient learning. The still unanswered question is, how can the values of a general education be made immediate and real?

In an attempt to be practical, I have endeavored to work out a lesson plan for the teaching of an understanding. This plan is not presented as an example of how to do it, but merely as a stimulus to thought and criticism.

An Attempt to Indicate a Classroom Procedure for the Teaching of a Generalization

a. *The Teacher's Purpose*: To bring about pupil activities which will result in the establishment in each student's experience of the idea that, "I can increase my strength by using any device which will cause my muscular effort to move through a greater distance than the weight I wish to move."

b. *Step One:* Introduction of the generalization

Arrange on the demonstration table many different tools—real tools, not toys. Hammer a nail into a board and ask for a volunteer to come forward and pull it out with his fingers. This usually results in a laugh, but often several of the students volunteer to show how the nail can be pulled with various tools. From this it is a simple matter to point out the principle of the lever and its application to each of the tools used.

c. *Step Two:* Summary of the demonstration.

By class discussion draw out of the students a summary statement of what made it possible to pull the nail; i. e., in the use of each tool the distance from the hand to the fulcrum was greater than the distance from the nail to the fulcrum. This makes the arc through which the hand passes greater than that of the nail. Nature usually compensates, and so the force on the nail will be greater than the force on the hand. (The degree of difficulty of the statement and the mathematics involved should be varied to suit the ability of the class.)

d. *Step Three:* Realization of the generalization by the student, and application of the scientific method.

Next, put the students to work solving simple problems that apply the principle demonstrated. When possible, the students can suggest their own problems, but usually they prefer to depend upon the teacher.

Sample problems.

1. What arrangement of weight, fulcrum, and effort will give the best results with a crow bar? Apparatus: Weights, bar, and spring scales to measure the effort.
2. Is it possible to lift the same weight with less force if the bar is used as a second class lever?
3. How does the weight of the bar affect the results in each of the levers used above?
4. Is it possible in increase speed with a lever? If so what does the speed cost?

In giving the results of the problems each student should first arrive at a hypothesis, plan his procedure, give the results of his experiment, and come to a conclusion.

Note: This whole first lesson on the generalization might take one fifty-minute period. The change of activity from listening, to experimenting, to writing is an important factor in keeping everyone's attention. A lesson of this type requires very clear directing by the teacher and often misconceptions need to be cleared up the following day.

Since the purpose of this paper is to raise questions I would like to close with a few. If we keep in mind as a background for these questions the fact that synthesis around understandings for the interpretation of daily life has been suggested as a way out for science teaching, these questions seem pertinent.

1. Are we adequately meeting the need in the high school for an introduction to specialization in science, as represented by the logically organized courses in chemistry and physics? (This question is asked on the premise that logical organization is the most economical way to learn

scientific facts and principles to use as tools. Also it is assumed that when an organized body of information becomes a means to an end it automatically becomes functional.)

2. Is it true that little is being accomplished toward the teaching of the scientific method to the point that it functions?
3. If the use of the scientific method has contributed largely to the rapid advance in scientific knowledge would its equivalent application to social and economic problems result in a similar advance?
4. If an attempt were made to have students follow the general plan of the scientific method as they tackle and write up the solutions to problems in all subject fields, would progress be made toward making this method a common tool?
5. Would a constant re-acquaintance with valuable and useable generalizations of science throughout the school years result in a more permanent learning residue than results from the present flashlike exposure of today? (The generalization approach refers to the organization of subject matter around important understandings that ramify into human affairs through thinking, feeling, and acting. Example: I can increase my strength by arranging any device which will cause my muscular effort to move through a greater distance than the weight I wish to move.)
6. Should science in general education be organized around areas of usefulness such as the city water supply, chemistry of the home, how to put out a fire, how to select a good automobile, etc.? (Here the information is more specific and more detailed. Many of these situations can be grouped around a generalization in the hope that the generalization will thus become more permanently learned.)
7. Should science in general education become the application of scientific principles to the needs of the adolescents, as developed in a core course. (Everyone needs experience in planning his activities and making decisions concerning them.)

A GENERAL EDUCATION COURSE

in the Foundations of Physical Science

By Anton Postl

Assistant Professor of Science, Oregon College of Education, Monmouth

Introduction

IN THIS BRIEF OUTLINE no attempt will be made to defend the existence of this type of course but rather to find a way of teaching it in a manner which will make it a worthwhile and satisfying experience for the students.

In organizing any activity one must know one's goals and hence a brief statement of the objectives for such a course follows:

A. *General Objectives*

1. To acquaint the students with the true aims of scientific endeavor.
2. To show the interrelations of the various branches of physical science which will enable students to obtain a unified picture of their physical environment.

B. *Specific Objectives*

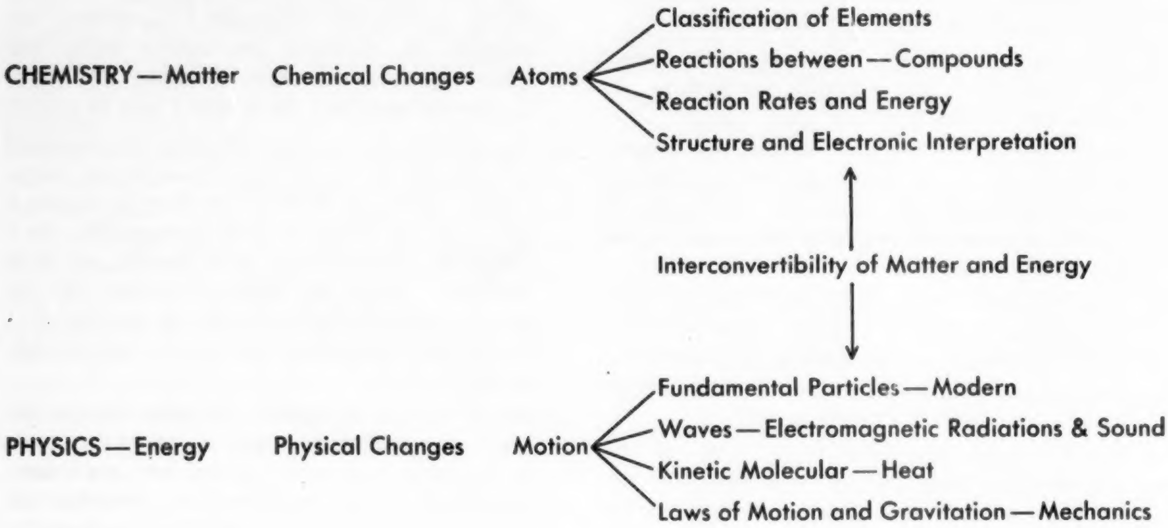
1. To provide the fundamental background necessary to an understanding of the basic principles covered in the different branches of the physical sciences, an understanding which should lead to greater appreciation and enjoyment of their physical surroundings.
2. To provide an opportunity for students to work in an actual laboratory situation which will impress them with the need for objectivity, honesty, accuracy, and thoroughness, thus acquainting students first hand with the methods of the natural sciences.
3. To acquaint students with the literature sources appropriate to their level of understanding, enabling them to keep up with current developments.

A number of different approaches might be used to accomplish these objectives. Johnson (1) distinguishes the following characteristic approaches of science survey courses:

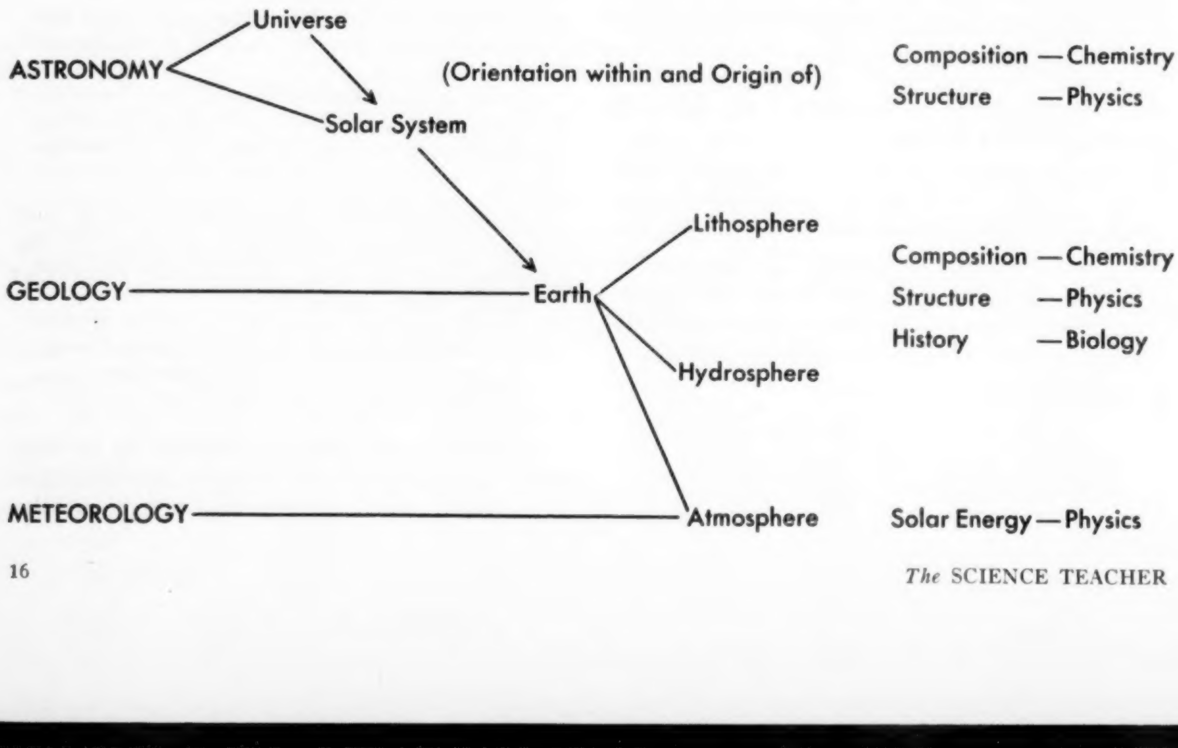
Interpretative	vs.	Pure Science
Selective	vs.	Comprehensive
Descriptive	vs.	Analytical

From the eight different combinations of these course characteristics the Interpretative—Selective—Analytical appears to be the best suited to achieve

THE FUNDAMENTAL BRANCHES OF PHYSICAL SCIENCE



THE APPLIED BRANCHES OF PHYSICAL SCIENCE



the objectives listed above. Certainly a general education course is not one in which science is studied per se, and hence the interpretative approach appears more reasonable. The encyclopedic comprehensive type course often attempted in survey courses can lead only to a frustrating experience for both instructors and students when the well-nigh impossible is attempted of covering the field. This type of approach is also brought out by some of the voluminous comprehensive texts in the field which pride themselves also on being up to date by including the most recent technological applications. In selecting topics, on the other hand, care should be exercised not to restrict the topics to so few that the student will not see the interrelations and thus lose the perspective of unity, and at the same time still be completely uninformed about large segments of his physical environment. Finally, if the course is one in which true learning is to take place, it cannot be done by ladling out information to passive receivers but must be done in an analytical manner where students actively participate in discovering the many relationships, be they of a historical or quantitative nature or otherwise.

The present trend, as seen from the current literature sources, with this type of course at most institutions of higher learning appears definitely to be away from the comprehensive, thus almost inevitably superficial survey approach to the selective where fewer well-chosen select topics are more thoroughly treated. The "Block-and-Gap" type of approach by Rogers (2) seems to be an attempt at a synthesis of these extremes.

The actual implementation of the objectives set forth earlier in this paper would seem to exclude the use of a Single-Science Type Course though Alyea (3) defends this solution as the only means of enabling the student to reach a maturity in the field after first becoming conversant with the language and facts peculiar to the particular field, and he feels that the student could reach this maturity in only one branch of the natural sciences. Taylor (4) on the other hand felt that "The Single Science Type of Scientific Appreciation Course" was only a temporary stop-gap measure due to the lack of a sufficient number of adequately prepared instructors who could handle the multiple science course, and it might be added that this was his opinion in spite of the fact that he is accredited by many as having achieved outstanding success with the single-science type course, as his text (5) would also verify.

Selection and Integration of Topics

A course in the foundations of physical science normally includes materials from the following five branches:

A. Astronomy
B. Chemistry
C. Geology
D. Meteorology
E. Physics

The branches have been listed alphabetically without regard to actual order or relative importance.

According to one source (6) the criteria for effective course organization are:

Continuity,
Sequence,
Integration,
Knowledge of Organizing Schemes

It would appear that a single staff member conducting the course would be better able to achieve the first three of these criteria than a group of experts in the respective branches. With the proper professional respect for high standards most instructors should be able to deal with the material on the level of a general education course in a thorough enough manner though additional formal study in the less familiar fields and in teaching college students would be highly desirable.

The actual organization of the subject matter is a task which is obviously complex and when attempted by any one individual also subjective. After several attempts at different ways of organizing which will serve to bring out the unity and interrelationships it seemed that the only concise and clear solution was in the form of charts. The branches of physical science can logically be divided into the fundamental or parent branches of chemistry and physics and the applied branches which include the remaining three. It is hoped that the accompanying two charts will be at least partially successful in pointing out the underlying unity which needs to be emphasized instead of following up the innumerable isolated factual details of the physical sciences.

A problem solving type of approach centered around a selected topic of general interest and proceeding in an inductive manner and one which will bring in any or all branches necessary for elucidation would likely be best suited to bring out the unity and interrelations. In another approach a particular topic could be historically introduced by showing the accumulation of descriptive knowledge and the development of basic principles on the basis of quantitative relationships obtained from instrumental measurements.

The final implementation will, of course, have to be left up to the individual instructor to suit his

STUDY OPPORTUNITIES FOR SCIENCE TEACHERS

After two years of "assigning" their fellowships to teachers within selected school systems, the Ford Fund for the Advancement of Education announces that this year the plan is "open to all" secondary teachers throughout the United States and its territories. *Contact your own superintendent of schools* with your desire to make application. Forms for individual applicants have been distributed to superintendents in all high school districts. The fellowship award is generally equivalent to the regular salary of the teacher, but not less than $3000, plus a reasonable allotment for necessary transportation or tuition in case of registration at an institution for additional work.

The Westinghouse Educational Foundation will again offer fellowships for secondary science teachers for summer courses to be given at Carnegie Institute of Technology and Massachusetts Institute of Technology. For information and application forms for the Carnegie program, write to J. M. Daniels, Chairman of Admissions, Carnegie Institute of Technology, Pittsburgh 13, Pennsylvania. Chairman of the MIT program is Professor Davis, Chemistry Department, who will answer requests for information and application forms.

The General Electric Company offers six weeks of expense-free study next summer for two hundred science and mathematics teachers from 24 states. Four programs will be operated at Union College, Schenectady, N. Y., for science teachers; Rensselaer Polytechnic Institute, Troy, N. Y., for 50 mathematics teachers; Case Institute of Technology, Cleveland, Ohio, for 50 physics teachers; and Purdue University, Lafayette, Indiana, for 50 mathematics teachers. Each college will select its candidates on the basis of their qualifications and credentials and will conduct the courses which can be taken for credit for an advanced degree. Applications should be made to the colleges. Purdue will accept applications from these states: Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, West Virginia, and Wisconsin. Case is accepting applications from the same states plus Western Pennsylvania. States from which applications are being accepted for Rensselaer are: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and District of Columbia. Union College is accepting applications from these same states plus North Carolina.

own personal background and philosophy. The instructional procedures, however, should be varied enough to include a number of different means of communication such as lectures, discussions, problem periods, demonstrations, laboratory work, field trips and other audio-visual aids.

This paper has primarily limited itself to the broad organization of the subject matter of the different branches of the physical sciences. Needless to say there are many worthwhile by-products that should come out of such a course.

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THE *Functional* ◁ ◁ ◁ ◁ ◁ ◁ ◁

▷ ▷ *Approach* IN GENERAL SCIENCE

By EMILE C. FONSWORTH

Chairman, Science Department, Yates High School, Houston, Texas

A number of science teachers have found out through study of the problem that learning in general science can be made increasingly interesting and appealing through use of a variety of classroom approaches to the same study problem. Some, on the other hand, have been slow to let go of the fact-cramming techniques so popular in days gone by. There remains that lurking fear of missing certain "vital and fundamental" content as the change is made from the lock-step procedure to one involving simply inquiry by individuals or groups of pupils. Science teachers who have tried an individual or small group approach have been convinced that skill in use of the scientific method can best be achieved in classrooms where content is wide and varied. Under the stimulus of the appeal through novelty and interest, students can be encouraged to cover more science work than they usually cover in the logical subject matter approach. In a multiple approach the way is opened for the introduction of problem-solving methods, for sharing experiences, for promoting working relations, and for developing skills in choosing alternatives. Furthermore, the problem-solving approach with students can make subject matter more functional and meaningful.

This article contains a brief description of how a science instructor led his junior high school class to the realization of some of the values of the problem-solving approach. This group had already some science experiences in connection with their activities in the elementary grades, where they studied the home and community. In their first quarter of general science they had studied astronomy in order to get a better understanding of the place of the earth and the solar system in the universe. In the second quarter, they planned with the teacher to explore some of the more formal divisions of physics by working on certain selected problems. The students were motivated in their choices by the felt need for developing better understandings of certain principles encountered in their earlier work with machines and scientific gadgets found in their own environment. It was decided that the problems selected for study would be confined to the four broad areas: (1) how certain electronic devices work, (2) what laws govern the operation of machines, (3) what principles of light control the working of optical instruments, and (4) what energy conversions take place in the internal combustion engine.

The class of thirteen students was then divided into four groups, with each group selecting an area and each member within the group assuming responsibility for a project or a part of a project. It was agreed that group members would first master their individual work, and then make a report, with demonstrations, before the whole class; after which a test made out jointly by the teacher and the group would be administered to the class. The following progress report written by one of the students will help make clear the nature of the group attack:

> After the class consented that our group would be permitted to work on machines, which we were plugging for, we then decided among ourselves who was to work individually on inclined planes, pulleys, or levers. We then went to the library to get some starting information on our topic. After we had read we wrote out a guide sheet and bibliography for the class, and then we made plans for our own individual projects. After working through our projects and checking on the reading done by the whole class, we began to report and make demonstrations. The class got so interested that they set up other problems on machines and worked through them with the help of our group.

By the end of the third week group reporting and demonstrating were well under way. The group on electricity gave demonstrations with magnets, motors, vacuum tubes, and radio sets. They used charts and moving pictures to clarify concepts about the nature of electricity and the working of electrons in television. The group on the gas engine used a working model that had been made by a previous class to demonstrate the gas engine cycle. The principles of energy change and transfer were explained by the use of moving pictures followed by discussion. The group on light added novelty by giving demonstrations with a

telescope borrowed from a hobbyist and by arranging for a work period in the University Spectroscopy Laboratory.

This work took up only seven weeks of the time. But the teacher foresaw this possibility of short-term projects during the planning session. The class readily accepted the suggestion of using whatever time remained within the quarter to work on individual projects of their own choosing. The selection of individual projects began in the eighth week. Although a few students selected their projects without help, it was necessary for the teacher to present a number of suggested projects, to help students make choices in terms of value to them, and to discuss ways of working them out. But during the eighth week, all students but one selected a project, went ahead planning it with the aid of the teacher or some other available resource person, and settled down to the job of working it out under guidance. Their projects included setting up a balanced aquarium and terrarium, dissecting frogs and studying physiological effects, building a periscope, work in table-top photography, making projection prints, studying the characteristics of vacuum tubes, purifying water, and the fractional distillation of petroleum. It was clear that all the work might not be completed by the end of the quarter, but the teacher's experience with other classes working in similar ways had indicated alternative ways of continuing the work with satisfaction. Some projects could be carried home for completion or further work in student laboratories. Some students could come to the school to work on projects or look after experimental animals and plants during out-of-school days. In some cases, involving long and continuous work periods, students could spend the needed hours without interruption on interesting problems. And there was always the possibility of extending the work over into a new quarter.

The question arises as to the appropriate role of the teacher when a science class works this way. The truth is that his is no easy task. He may expect to expend more than the usual amount of energy due to the demands of new kinds of duties. The success of the class work depends upon a large amount of planning, both in and out of class, especially at the beginning of activities. Students must be helped all along, both in and out of class, in executing their plans successfully. Even though the children are allowed to choose their problems and projects, a large variety of materials and suggestions must be available to stimulate their thinking and imagination. It is the responsibility of the teacher to take the leadership in providing a rich and challenging environment. Audiovisual aids must be selected and secured at the proper time. Reports, demonstrations, and tests must be prepared and checked. These call for time and energy both in and out of class. Yet the work within the actual class is made no easier, because of the variety of activities going on at once. The teacher must move from group to group, even from individual to individual, each with a different problem or difficulty. He must keep up with the progress of all and render assistance wherever and whenever needed. He must be on the alert for lagging interest, find out the cause, and renew the interest.

The teacher's responsibility extends beyond his own classroom. Although librarian, shop teacher, and resource persons cooperate in helping the students with their work, the science teacher is primarily responsible for the success of the whole venture. Students in general science find it necessary to work in various laboratories and places because of the differences in their types of work. The science teacher must be sure that they work intelligently and within limits of safety. But with careful planning and stimulation both teacher and pupil can acquire the discipline and the skills needed for carrying on simultaneously a variety of interesting and novel learning activities.

Teachers who try this approach to the study of general science must not expect too large returns at the outset. They must be patient and willing to work hard in helping students discover new values and new skills necessary for success in functional approaches. Students will need much help in building rich experimental backgrounds, and this task, while not easy, usually pays increasingly large dividends as the work proceeds. It will be found necessary to stimulate students and make them eager to attack their own problems, to accept cheerfully the responsibility for planning, thinking, and working that accompany such self-imposed tasks, and to build within themselves a driving consciousness of high standards of excellence.

The quality and the nature of work done in a permissive and cooperative atmosphere depends upon a number of factors. The amount of science already studied will certainly increase the fund of information available for new work. But the ways and methods of previous science study are perhaps far more important. Under proper guidance and provision for science study through the grades, students can bring to general science in the junior high school an amazing zeal for studying science as well as a very rich background upon which to

draw. There are many examples of elementary school teachers who are using excellent approaches to the study of science as experiences in their total activities. The children are encouraged to choose problems, to plan their attack under the direction of the teacher, and to select and organize data upon which to base conclusions which are tested in action. The elementary science program in many cases now includes the community as a laboratory, and science projects are being set up for study in the classroom.

The general science teacher in the junior high school who receives children with these rich experiential backgrounds must accept a new challenge. He must be ready to nurture their zeal, interest, and skills by affording a wide variety of exploratory activities into all the sciences without regard for the outmoded limits set for conventional courses. His charges must be freed, and he must be prepared for the new responsibilities of larger content and improved methods. Where elementary and junior high students are still denied these novel and stimulating ways of studying science, the general science teacher as the key-man in the science program has an even larger responsibility. His immediate job is to help his students to overcome their deficiencies and to gain the more useful competencies. His long-range responsibility is to accept the leadership in working for sound changes in the elementary and junior high science programs. He must work untiringly to help other teachers to discover value in directing students to study science through problems that hold interest and meaning for them, and he must also help other teachers gain the competence needed for success in such an approach.

DO YOU HAVE ANTS IN YOUR PLANS?

By F. A. HANAWALT

Professor of Biology, Otterbein College, Westerville, Ohio

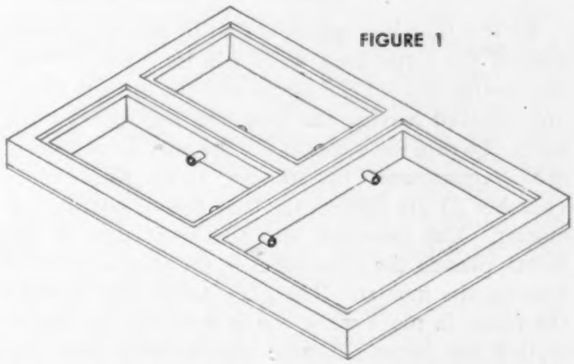
SINCE there are more different kinds of insects than all the other kinds of animals it is proper that we give them considerable study. The study is rewarding for the special adaptations they exhibit are not only strange but wonderful, and they never fail to interest us all from the tottering child in his first steps to the equally tottering senile individual.

Since so many of our young people have only a very limited opportunity to see the great variety of insects of the countryside it is important that we bring insects into the classroom. A colony of dermesteds, skin beetles, can easily be established and used to show how destructive they are to dried skins, furs, and other animal tissue. Moths that attack woolen garments can be used to show their destructiveness. A termite colony should be set up, especially in areas where termites are pests. Bees are often provided in observation hives and always prove interesting.

The list of possible demonstrations of live insects is too long to continue further. It is the purpose of this article to show how ant colonies can be set up easily and at very little expense. The ant nest described can be made from material classed as waste. Details of construction are given by means of the drawings.

Figure 1 illustrates the ant nest with its three compartments. In this nest ants can pass from one compartment to another through tubes provided for this. Each compartment is covered by its own

FIGURE 1



sheet of glass so that one compartment can be examined without disturbing another.

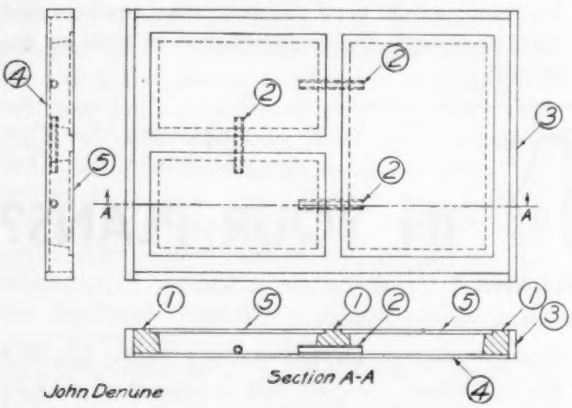
Figure 2 shows the structure more in detail. One starts by placing a piece of glass, approximately 9 in. by 12 in., or any other size desired, flat upon a work table. This glass base is marked number 4. A piece of sheet metal can be substituted for the glass and some prefer this for the metal excludes light which should not enter the nest chamber. If glass is used for the base it can be covered with black paint after the nest is completed.

Make a frame (number 3) for the base of the nest. This frame should be about three-fourths of

an inch high and since this determines the depth of the compartments it should be made to fit the type of ant that is to be housed. The frame should fit reasonably snug around the base so that the mortar used for the walls will be retained when the walls are poured. Plaster of Paris can be used but a commercial patching plaster is better for it is slower in setting up.

Three forms (number 5) are made, one form for each compartment. The forms are set upon the base of the nest and are built so that a space of half an inch is left between the forms themselves and between the forms and the frame when properly placed.

FIGURE 2



By this time it is apparent that by pouring mortar around the forms nest walls will be made. When the mortar has set the forms and the outside frame are removed leaving the base and the walls of the nest. To provide a means for the ants to pass from one compartment to another three glass tubes (number 2) are laid on the base before pouring the mortar. Cut channels into the lower part of the forms, placing the glass tubes in the channels before pouring the mortar. The glass tubes help to hold the forms in place while one is working the mortar around the forms, likewise the channels keep the tubes in proper position. After the mortar has set the three forms and the frame can be removed and used over and over to make duplicate nests at very little expense.

Thin sheets of plywood or pressed board can be used to advantage for the tops of the three forms. The lower part of these forms should be of something easily worked such as insulating board. The sides are sloped as indicated in the drawing, making it easy to remove them after the nest walls have solidified. It is helpful to cover the lower part of the forms with vaseline so they can be removed easily from the mortar. A screw inserted about half way into the top of each form helps in placing them and also is useful when the forms are to be removed from the mortar.

One or both of the small compartments can be used for the ant nest proper and should be loosely filled with ant nest material. The large compartment is used for a food chamber. Provide the nest proper with a cover which will exclude light. This is easily done by using a black sheet of paper between two glass plates: the top glass and paper can be removed and the colony can be observed at work, through the remaining glass plate.

In an active colony it is convenient to have holes drilled in the cover of the large compartment, for introducing food or water. Holes can be drilled in glass by the use of a small triangular file. Insert the file in an ordinary hand brace, break the file leaving a few inches of it in the brace and use this for drilling. The holes will have to be kept stoppered of course. Wood plugs are better than cork for this as ants may chew away the cork and escape. Use a very shallow small dish under one of the holes for water.

Ant colonies can be secured easily by tracing an ant carrying food to its nest, then digging out the nest and transferring a queen, some workers, and some of the natural nesting material to the artificial home. If larvae and pupae are secured also the colony will be more likely to establish itself at once in the new environment. The smaller ground ants are more easily reared than larger ants, or carpenter ants found in tunnels of decaying wood. Queens captured at swarming time along with some attendants will start a colony.

In winter, observe potted plants and benches in greenhouses where ants may be found. If one is fortunate an entire colony can be taken in a single pot of flowers where they have built a nest, passing in and out of the drain hole of the pot. Colonies can be secured from biological supply houses but it is part of the fun to collect one's own colony.

Since these ant homes can be made at such little expense, several should be made and offered to any student who wants to try to get a colony established. This will lead to other experiments by class members and should stimulate interest in many phases of the study of biology.

Elementary Science

BRING THE SKY INTO THE CLASSROOM

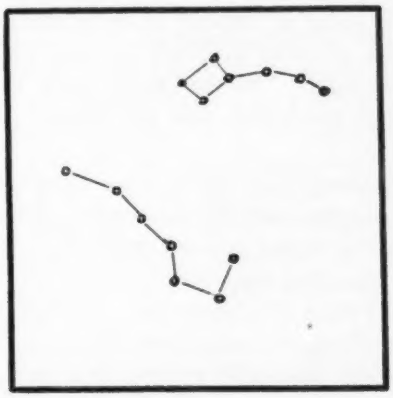
By CHARLES E. BURLESON

Assistant Professor of Science and Education, San Francisco State College, California

"WHY, THEY LOOK ALMOST REAL!" These words were spoken by a fourth grade teacher upon seeing the group of "stars," making up the constellation Orion, projected on a screen in a darkened room. And she was right; they did look almost like the real thing.

The study of stars and star-groups, or constellations, is enhanced if we can employ graphic and realistic representations and models. Except for some of the better known constellations like the Big and Little Dipper, it is not easy for youngsters, or teachers, to locate and recognize many of the constellations which they study. This may be particularly true if one tries to see pictures of bears, hunters, dogs, horses, and the like which the ancients imagined they saw in the sky.

One of the most effective and realistic ways of picturing constellations is through the use of easily prepared slides. To make these, cut 2″x2″ or 3¼″x4″ blanks from heavy black construction paper. Using a star map or chart for a guide, punch clean holes through the blank with a pin or needle. (Star maps are published in the last issue of every month of the *Science News Letter*, or may be found in many science books.) Each hole represents a star in its proper position in the group.



Constellation slide showing Big and Little Dipper. Slide measures 2″ x 2″ and may be used for model.

The relative brilliance of the star is indicated by the size of the hole. While it is generally desirable to put only one constellation on each 2 x 2-inch slide, several may be included on the 3¼ x 4-inch slide. Care should be taken to have the constellations appear in proper relation to each other. A good multiple grouping, for example, might include the Little Dipper, Draco, Cassiopeia, Cepheus, and the Big Dipper, these being the prominent star groups closest to the North Star, or Polaris.

The same technique lends itself effectively to picturing star clusters such as the great cluster in Hercules. Near the center of a slide draw a circle about one inch in diameter. Starting at the center of the circle punch many small, clean holes through the slide. The holes should be very close to each other at the center, gradually becoming less concentrated toward the edge of the circle. Comet slides are made by outlining the general shape of a comet, the head of which is made with many fine holes as in the cluster slide, with fewer holes for the tail. Slides of galaxies, particularly the pinwheel galaxy, can be similarly made. If one wishes to increase the permanence of these slides they can be mounted in commercial cardboard mounts. Or they can be placed between glass plates and the edges bound with tape.

Some teachers will want to have children do some research on myths associated with the various constellations and report to the class at the time the slides are used.

Window displays of constellations can be prepared by using large sheets of black construction paper and punching holes with a pencil for the stars. These require no projector. Tape them to a window and mask the slide allowing the light from outside the room to enter through the holes.

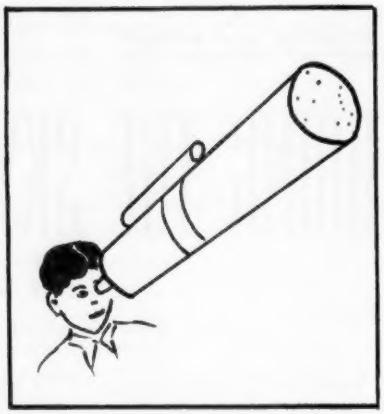
An interesting variation of this is the use of a "make-believe" telescope for viewing star groups. The "telescope" is fashioned from a cardboard mailing tube having a diameter of several inches—the larger the better—and several feet long. If desired

the telescope can be fitted with mount, dials, eyepieces of smaller tubes, mirrors, or other embellishments to give it a professional look. For the slides, cut circles from black construction paper having the same or slightly larger diameter as the telescope tube. Make the constellations as described above. The slides are then taped over the end of the tube and viewed through the opposite end by pointing the tube toward a window or some extended source of light.

For those who wish to experiment with slide-making, many interesting effects can be obtained by using glass slides that have been smoked in the flame of a candle. Stars can be made by removing small amounts of the soot from the slide at appropriate places with a sharp-pointed instrument. Lines can be drawn from star to star in the group if so desired, and a skillful person can outline mythical figures which the group is supposed to represent.

There are many other kinds of instructional aids in the study of constellations. Excellent models can be fashioned from any one of a number of "Tinker-Toy" type sets. Here again it is necessary to have star maps or charts to guide in the proper positioning of the stars. The wooden disks or balls of such sets usually have sufficient holes for the connecting rods so that the correct placement of the stars presents no major problem. Several constellations can be constructed with one set. The models may be effectively displayed by attaching to the ceiling, suspending from the ceiling by thread, or attaching to walls or bulletin boards.

Small clay or plasticine balls with pins pushed through them and arranged as constellations make easy and attractive bulletin board displays. Ping-pong ball groups, while more expensive, make attractive models when glued on a contrasting background of dark blue or black.



"Make-believe" telescope. Constellation slide is taped over one end and viewed through eyepiece while pointing toward strong light.

Small disks cut from white cardboard and backed with either flannel or small pieces of coarse sandpaper can be used on a flannel board for an effective and flexible method of forming star groups. For those who like to use them, flash cards of different constellations are easily prepared using small gummed stars, or stars cut from construction paper.

Try some of these projects with your pupils, and bring the sky into the classroom. Efforts are particularly rewarded when they become joint enterprises of the teacher and the pupils.

Elementary Science

A Blue Sky for the Classroom

By HILDA TAYLOR, Sixth Grade Teacher
Seaford, Delaware

I was interested in the article, "A Ceiling Solar System," in the September, 1952 issue of *TST*. My group of children tried a similar project last year, unaware that the idea had been used previously to depict the solar system.

Our children were studying various objects in the universe and particularly the stars as they appear in the December sky. Our ceiling was used for the various constellations in their relative positions.

The children decided to depict the constellations Ursa Major, Ursa Minor, Draco, Gemini, Taurus, Orion, Canis Major, and the Pleiades. The children worked in groups and each group was responsible for a certain constellation. They found out the number of stars needed, the largest star in the constellation and the color with which it glowed, and the position of the star group in the sky. They made the stars from paper, making three-dimensional ones in most cases.

In the meantime, while this research and paper work was going on, another group of students made a network of string attached overhead to the four classroom lights. Another group made the many, many stars which were used to represent the Milky Way.

When these initial items were completed, each group hung its constellation in place, attaching its stars to the string network with other pieces of string. The final step was to cover the complete network with a continuous mass of blue paper to give the effect of stars suspended in a blue sky. The children thoroughly enjoyed their work and the project proved to be an effective way of promoting desired understandings about the constellations.

The Science Fair Is Easy

—IF YOU LET THE STUDENTS DO IT!

By **ROBERT D. MacCURDY,** Biology Teacher, The Senior High School, Watertown, Massachusetts

and

C. RICHARD LEACY, Science Fair Chairman, The Senior High School, Watertown, Massachusetts

FOR YEARS we have been teaching about activities, student participation, democracy, and cooperation. The school science fair offers a real opportunity to practice what we preach. Give the students the problem to solve. Make it possible for them to manage and execute your science fair as a student activity with your faculty, relieved from the labor, serving as consultants. We tried it, and it works! For two years we have had a student-operated fair. A brief description of our peculiar problems, solutions, joys, and sorrows follows for your guidance and help.

Every activity needs a leader. Each year we found one equal to the task. The general chairmen had the needed qualities of intelligence, initiative, drive, experience, administrative ability, and the ability to work with people. A general operations committee was formed with an associate to assist and a faculty member serving as consultant. They used the Cambosco Scientific Supply Company's brochure, METHODS OF CONDUCTING A SCIENCE FAIR, as a guide for all operations. (This brochure was widely distributed through the *"Clip'n Mail"* pages of THE SCIENCE TEACHER.) Suitable leaders as chairmen of the necessary sub-committees were immediately selected. Each chairman appointed members from the Biology Club and science classes, and the first general pre-fair meeting was held. The faculty consultants attended this meeting, at which time all introductions were made, the history and philosophy of the science fair movement generally and locally was traced, our goals were set, our limits and policies were established, and responsibility and authority were defined. Following this initial meeting, four meetings were held by the general chairman and the chairmen of the sub-committees. At these meetings problems of the various committees were brought up and everyone worked together to solve them. Some of the highlights and more interesting features of their work are here reported for the guidance of all who care to apply them.

We discovered that there had to be one central agency that could solve the problems which arose within the various committees. When such problems were presented, the general chairman would call a meeting of all the committee chairmen. There they would solve problems concerning rules, awarding certificates, presentation ceremonies, program material and form, expenditure of money, and assignments of special duties as there was call for such assignments. All final policies were made by the general chairman and his associate. It is opportune to point out that it is an absolute necessity, if a fair is to be a success, to have one recognized supreme authority. Because we were lacking in this respect, as you will later see, we had problems that could have been easily avoided.

The chairman of the Committee on Judges selected and sent invitations to all those whom we desired to judge our fair. It proved to be wise to invite a few more judges than we anticipated would be needed. There is always the need for more than originally planned for. Judges were invited at least one month in advance. This gave them plenty of time to accept or refuse our invitations. The chairman greeted all the judges and attached a small identification sign to the coat of each. Such a sign serves as an "ice-breaker" when he comes in contact with the other judges and at a Judges' Tea

A planning session of the student committee for the Watertown Senior High School science fair

or whatever you may choose to have for them in the way of refreshments. We had 21 judges for our 130 projects. Refreshments were prepared and served by our Quid Nunc society.

The first duty of the chairman of the Financial Committee was to submit a proposed budget which was duly approved by the general chairman, headmaster, and the superintendent of schools. All other last minute financial matters went through the hands of this chairman. He received all bills, approved them, and passed them up the line for payment. Here is an instance where uncertain authority caused some problems. Bills were submitted for payment that had not been previously approved because of a misunderstanding as to who was the ultimate authority. It is wise, we found out, to make clear to all connected with the fair who has final approval and what the system of finance is.

We found ourselves in another predicament because of uncertain authority within the Floor Plans Committee. Because we labored under several floor plans with three different people directing operations, we ended without a satisfactory or systematic arrangement of the entrants. To avoid such a problem, we should have set up well in advance one floor plan which would tell (1) how many entrants there were, (2) where each entrant was to be, and (3) what, if any, utilities each entrant needed. If entrants are grouped according to utility needs a great deal of last minute changing would have been avoided.

A most important committee is the Publicity Committee. This chairman saw to it that the public was informed well ahead of time about the fair, where it took place, who sponsored it, and when the doors opened to the public. He used the combined forces of hand-delivered leaflets, newspaper articles, radio announcements, posters, and school notice announcements. The art department of our high school was willing to make the 100 posters we used.

The Program Committee found that the programs were not worth the effort it took to print and get them out to the people at the science fair. This committee decided that another year we would not print programs or have any individual programs. We suggest instead that you have one large sign consisting of all entrants' numbers, names, and titles of projects posted at a central point that is easily seen from all points on your main floor. We plan to do this in the future.

The Awards Committee designed a certificate which would tell the place won by the contestant, bear the seal of the high school, and be signed by the officials of the science fair. A committee was appointed to do the necessary work but the general chairman can handle the matter himself if he has to.

The Committee on Standing and Scoring consisted of members of the faculty who teach science. For chairman, we selected the head of our mathematics and science department. Under very speical conditions only should this committee be run by the students. This committee computes the ratings given each project by the judges and thus determines the winners of the science fair.

The chairman of the Rules Committee has to acquaint each entrant with the rules of the fair. The best way to do this, we discovered, was to duplicate them and give each entrant a copy.

If desired, the general chairman may set up a Committee on Special Arrangements to care for inevitable last minute details.

For the presentation of awards, we suggest that you plan some small ceremonies in the auditorium of your high school. We had the faculty consultant of the committee on general operations give an opening address of not more than three minutes, and the general chairman said a few words and acted as MC for the rest of the ceremonies. For the actual presentations, we were fortunate to have our superintendent of schools present the awards. Generally, audiences can't take more than a total of 30 minutes of such ceremony. Speeches should be very short and *very few*. We discovered that a total of three speeches of not more than three minutes each with a minute or two for leeway was advisable.

There are always those who drop out at the last minute. To fill in their places, we had students who decided that they wanted to enter the fair at the last minute waiting in the wings to fill in. We set a deadline of 2:00 P.M.; all students that had not reported by that time to set up were dropped, and we let the standees take their places.

At the end of the fair we found a mess which we had to clean up. It is advisable to have a crew of students who can clean up that night or the next morning. Because we failed to plan carefully for such a crew, the general chairman and several assistants had to come into the school the next morning and clean up—with the help of the faculty consultant!

Approximately one week after the fair, we held a post-fair meeting of all committee chairmen to collect data in folders to leave for those who will assume our duties next year. In this way we can assure true progress, for we have taken the science fair a few steps on the road to success; next year some students will pick up where we left off.

PRECIPITATES

Announcements, News, and Views of Current Interest

A RESOURCE UNIT called *Using Electricity* and designed for use in a physical science course has been published by the Bureau of Secondary Curriculum Development, New York State Education Department, Albany. Practical, simple, and offering a wide variety of helps—including directions and sketches for 92 laboratory-type experiences, this book of 120 pages should be a boon to teachers faced with developing science courses for *all* of today's school population. No price indicated.

Two MOTION PICTURES that you can use with science teachers in training, in-service groups of teachers, programs of science teacher organizations, PTA's and Boards of Education, and with students are now widely available. "And To Fame Unknown" vividly portrays a day in the life and work of the high school science teacher; was produced by the du Pont Company and shown last fall on their TV Cavalcade of America program. To obtain a print for showing, write to Mr. A. H. Livingston, General Company Activities, E. I. du Pont de Nemours & Company, Wilmington 98, Delaware. The second film, "Decision for Chemistry," was produced by the Monsanto Chemical Company, St. Louis 4, Missouri. It may be obtained from this or branch offices of the company. Both films may also be ordered through the Manufacturing Chemists' Association, Mr. John A. Gosnell, Woodward Building, Washington, D. C. The NSTA office also has prints of the du Pont film available for loan to affiliated societies and other groups of science teachers. When requesting these films, please give three alternative dates. There is no charge or rental fee for either film.

SEVERAL SMALL PAMPHLETS to help parents (and teachers, too) answer children's questions about sex and to help teenagers understand themselves and many of their problems were recently published by the American Social Hygiene Association. Titles received include: Boys Want to Know; Girls Want to Know; Your Child's Questions; Parents—Tell Your Children; Know Your Son; Know Your Daughter; Preparing for Your Marriage. This material is available at 50 cents a set. The American Social Hygiene Association is supported chiefly through Community Chest and other united community campaigns. The address is 8 West 40th Street, New York City 18.

THE HEINRICH ACTINOSCOPE is now being produced and offered for sale by the Dumville Manufacturing Company, Box 5595, Friendship Heights, Washington 16, D. C. The device is described as low-cost (price not specified), self-contained, fairly rugged, and dramatic; designed for demonstration purposes but not quantitative work in studies of radiations.

FOR ELEMENTARY SCHOOL audiences, *Understanding Snakes* is a new filmstrip to help overcome fears about harmless snakes by showing their actions and habits. It also pictures how snakes may be fed and cared for. $3.50; order from Audio-Visual Materials Consultation Bureau, Wayne University, Detroit 1, Michigan.

NSTA NEWSMAKERS coming to our attention recently include: VIOLET STRAHLER (Stivers High School, Dayton, Ohio); new editor of *Ohio Academy of Science Newsletter*. WAYNE TAYLOR (Denton, Texas, Senior High School) and GLENN WARNEKING (Blair, Nebraska, High School); chairmen of their respective state Junior Academies of Science. HOWARD OWENS (Northwestern High School, Hyattsville, Maryland) was a featured guest recently on the Baltimore TV program, "Comeback." The presentation was built around Howard's magnificent recovery from crippling polio; it highlighted the work that he is doing today despite certain hold-over handicaps. Recall that seven of his students won an award or honorable mention in the 1953 program of NSTA-FSAF Science Achievement Awards.

THE 1954 SESSION of the National Training Laboratory in Group Development will be held at Gould Academy, Bethel, Maine from June 20 through July 10. Persons involved in problems of working with groups in a training, consultant, or leadership capacity in any field are invited to apply; 125 applicants will be accepted for the session. For further information, write to NTLGD at 1201 Sixteenth St., N. W., Washington 6, D. C.

RICHMAN—continued from page 11

a small community in Georgia, *it is happening* in other parts of Georgia to a greater or less extent and, people being people, *it could happen anywhere in the United States* or in the world."

It would be very difficult to point to any communicable disease which has been brought under control by treatment alone. It would be especially difficult in the case of syphilis and gonorrhea. There are many areas in the world where these diseases and the others, particularly chancroid, pinta, and yaws, are endemic in the populations. At no time in world history have so many people been able to move across the face of the earth so rapidly and so far. According to some medical historians syphilis was spread across the European continent in a matter of two or three years from the few sailors in the small ships of Columbus. It is logical to assume that syphilis and the other venereal diseases in these days of extensive and extended military operations and movements of vast numbers of civilian personnel from country to country are moving right along with their peregrinating hosts. Even the best of screening devices could not prevent this.

In order to help prevent duplication and reduplication of the West Point, Georgia epidemic in the United States, health officials and teachers may wish to consider seriously three proposals: (1) That teaching groups explore their curriculum needs and requirements in terms of presenting VD information to their students. (2) That health departments and teaching groups determine the type of material to be used and the method of presentation. And (3) that health departments, with advice from their teacher colleagues, develop and make available the needed materials.

The venereal diseases are down in the United States, perhaps as far as one knee. But they are old, experienced fighters, and they are fighting for their lives. For the first time in centuries, the initiative is with the forces for control. It would be tragic now to leave the field in the bland assurance that indiscriminate use of an impersonal magic drug will finish the job.

Estimated Economic Losses If Reservoir of Syphilis Is Not Treated

Disability	*Percent* of Total Cases*	*Number of Cases*	*Years Lost Per Case*	*Total Man Years Lost*
Paresis	2.0	40,000	23	920,000
Tabes Dorsalis	1.0	20,000	14	280,000
Meningovascular Syphilis with Psychoses	0.5	10,000	23	230,000
Optic Atrophy	0.5	10,000	14	140,000
Cardiovascular Syphilis	7.9	158,000	12	1,896,000
		238,000		3,466,000

*These percentages adapted from findings of the Bruusgaard Study.

The present reservoir is estimated at 2 million cases of syphilis. If these are not found, late manifestations could be expected to develop as indicated above. At $2,278 per capita per year (based on 1952 per capita income for the adult population) and 3,466,000 man years lost, it is estimated that an income loss of $7,895,548,000 would result.

Editor's note: In connection with the subject of this article, science teachers will be interested to know that Mr. Richman is now guiding the production of a motion picture on the same subject. Script for the picture, to be called *The Invader,* is being read critically by the following NSTA members: Mr. Arthur O. Baker, Cleveland, Ohio; Dr. Blanche Bobbitt, Los Angeles, California; Mrs. M. Gordon Brown, Atlanta, Georgia; Dr. Thomas Knepp, Stroudsburg, Pennsylvania; and Mr. David McNeely, Summit, New Jersey.

Classroom Ideas

Biology

Uses of Fresh Anatomical Materials Prepared by Deep Freezing

By P. J. FREEMAN and M. M. SHREWSBURY
Department of Natural Sciences
San Jose State College, California

The availability of a deep freeze refrigerator to this laboratory plus access to fresh materials has given rise to what we believe is a valuable aid to the teaching of anatomy. Models, graphic aids, films, and preserved material play a major role in the presentation of such a course in college or as a unit of biology in the secondary schools; but concepts derived from the sole use of the majority of such materials may often be misleading due to their emphasis on a diagramatic approach. Study of fresh materials aids the student by affording opportunity for first hand examination of recently functioning tissues and organs. He carries away from the laboratory a more realistic concept of anatomy than can be gained in any other way. A number of instructors, aware of these factors, have attempted to use fresh material in their teaching. The difficulty in such an approach has been the rather rapid putrefaction that occurs before the fresh material has been adequately utilized. Also, under such conditions when a number of laboratory sections are being offered, large amounts of fresh material must be obtained. Such a procedure was found to be cumbersome and expensive. To obviate these difficulties, the following techniques were employed:

Fresh material (steer, hog, and sheep) was obtained from a nearby slaughter house at intervals during the term. Dissection was performed within an hour after procuring such material. Pertinent structures were labeled and wooden probes were inserted into important passages. The preparations were then placed in shallow, enameled pans which could be stacked on each other using glass plates to prevent their sticking together. The pans were then stored in the deep freeze until needed. About three hours before a laboratory section was to use such material, it would be taken from the freeze. This permitted softening to the point of pliability and assumption of a natural appearance. Following the use of the preparation for about an hour, it would be returned to the freeze and refrozen. This practice was repeated at least five times for any one specimen as six laboratory sections were being offered in this college. In addition, the preparations were kept in the freeze and used weeks later for review and laboratory practical examinations. Despite this use, there was little distortion in the appearance of the material and putrefaction was kept to a minimum. This also allowed for a sizeable reduction in the amount of material to be purchased.

Elementary Science

Electromagnetism

By CARL UTBERG, JR., Horace Mann School
Pittsburgh, Pennsylvania

(Presented at the "Here's How I Do It" session (elementary), NSTA National Convention, March 21, 1953, Pittsburgh, Pennsylvania.)

Boys and girls need not wait until high school general science or physics to learn by experiment (a) that the more turns of wire wrapped around the iron core, the stronger an electromagnet will be, and (b) that by increasing the electric current through the windings of an electromagnet, the stronger it will be.

The equipment I use to demonstrate these two principles consists of two dry cells, a knife switch, two large nails, a spool of insulated copper wire (bell wire), and a box of paper clips. I made two electromagnets by wrapping insulated copper wire around a nail. One electromagnet had ten turns of wire and the other had forty turns of wire.

The demonstration included four simple experiments. In the first, the nail with ten turns of wire was attached to one dry cell; that is, the ends of the wire wrapped on it were attached to the dry cell. This electromagnet attracted eight paper clips. The

second trial was a repetition of the first except that two dry cells connected in series were used. This time the electromagnet attracted fourteen paper clips. In the third trial, the electromagnet with forty turns of wire was used with one dry cell and it attracted twenty-two clips. Finally, this electromagnet and two dry cells were used. This time it attracted thirty-four paper clips.

These experiments will stimulate much discussion and perhaps lead to other questions which likewise can be answered, at least in part, by additional experiments.

Chemistry, General Science

Spontaneous Combustion

By VERDINE E. TROUT, Science Teacher
Comanche High School, Comanche, Oklahoma

Demonstrations may be used for many purposes, one of the important ones being that of helping to develop understanding of principles or concepts. In demonstrating spontaneous combustion in chemistry or general science, many related ideas may be brought out. Prior to the demonstration and as follow-up, the class discussions may center on such ideas as oxidation, both slow and rapid, the air as a source of oxygen for burning, and kindling-point temperatures.

An effective way to demonstrate spontaneous combustion involves the use of a combination of zinc, sulfur, glycerin, and potassium permanganate.

First, thoroughly mix 2 g. of powdered sulfur with 1 g. of powdered zinc. Next place 1 g. of fine crystals of potassium permanganate in a crucible on an asbestos mat and then add three drops of glycerin to the crucible. Put the zinc and sulfur mixture into the crucible completely covering the other ingredients. CAUTION: Remain at arm's length from the crucible! In perhaps half a minute to 45 seconds the reaction will take place.

A spectacular demonstration may remain in students' memory only as a "magic show" or it may be used as a springboard to deeper learning. In discussing this demonstration, I try to guide thinking in the direction of (1) differences between mixtures and compounds, (2) burning as a source of most of our energy, and (3) rates of chemical change and factors that bear on the speed of reactions.

I have used this demonstration in chemistry in connection with the study of oxidation and in general science while studying energy. Students do not object to seeing the demonstration repeated two years apart in ninth grade and again in the eleventh, and the discussion emphasizes new ideas or takes us into deeper understanding of ideas previously discussed. The demonstration itself helps to maintain interest. It can be done without the sulfur and zinc but I find it much less effective.

Physics

An Inexpensive Demonstration Galvanometer

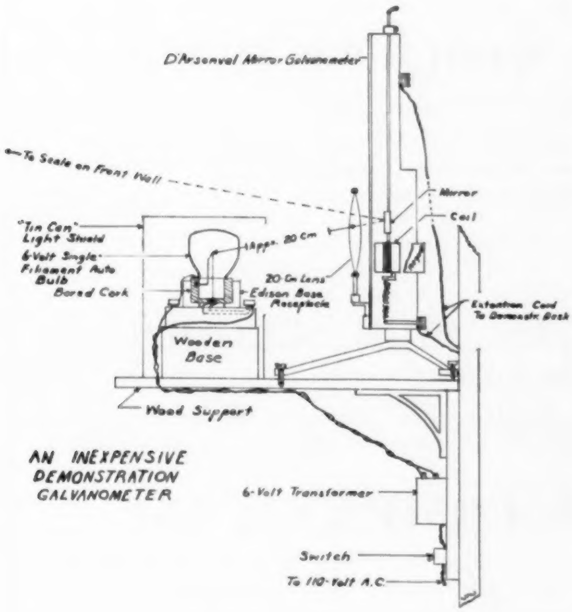
By WILLIAM T. WILKS, Professor of Science
State Teachers College, Troy, Alabama

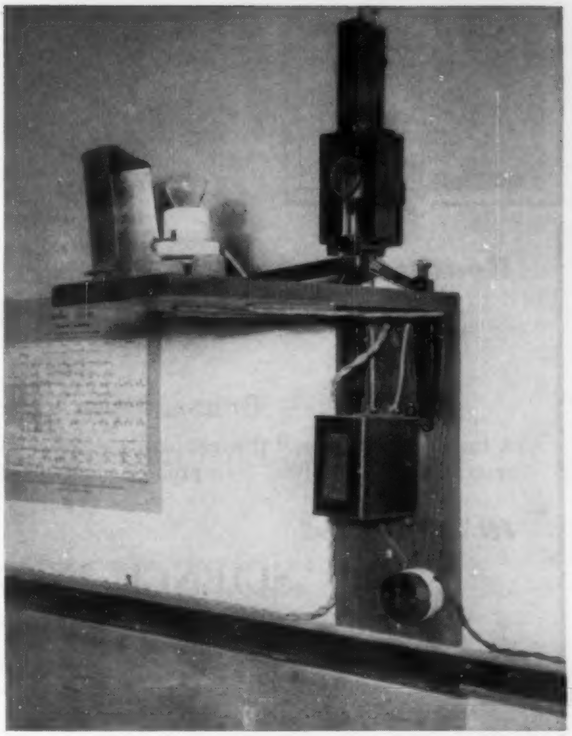
Many demonstrations used in elementary work with electricity require the use of a sensitive galvanometer whose scale can be read by all individuals in the classroom. The galvanometer described in this article has proved very satisfactory in work with large groups of students. It is relatively inexpensive to make and has the advantage of being easily constructed from stock materials which can be obtained from any laboratory supply house. The

instrument is sensitive enough to use in group demonstrations of such phenomena as thermo-electric effects, induced currents in coils, chemical cells of low emf, and Wheatstone bridges.

The diagram of the galvanometer is virtually self-explanatory. The wooden stand must be of rigid construction and firmly attached to the wall at the back of the room several feet from the ceiling. The galvanometer is of the standard D'Arsonval mirror type which is widely used by beginning students and which currently sells for something over ten dollars. The glass front is inverted to remove the stationary mirror from in front of the coil. The curved metal scale is also removed. The metal plate which holds the bottom of the glass pane is loosened and a standard optical bench lens holder is fitted in place as shown in the diagram. A 20-cm focal length convex lens is inserted and adjusted so that the top of the lens comes half-way up in front of the movable mirror of the galvanometer coil.

The light source consists of a 6-volt single filament bayonet-type automobile headlight bulb, a standard 110-volt porcelain receptacle, and a 6-volt transformer. These may be obtained from an electrical dealer or mail order house. A cork is selected which firmly fits the receptacle. A hole of the same diameter as the headlight bulb base is then bored through the cork. A piece of number 18 bare copper wire is attached to one prong of the bayonet base bulb before pushing the base firmly into the





Demonstration Galvanometer in Place (Light Shield Turned Back for Better View)

cork. Cut off the bottom of the cork so that contact is made between the bottom contact of the bulb and the spring contact at the base of the porcelain receptacle. Attach the free end of the copper wire to the other terminal of the receptacle. Connect to the 6-volt transformer as shown in the diagram.

The bulb and base are now mounted on the wooden stand at a distance of slightly more than the focal length of the lens. A little trial-and-error will readily locate the point at which the bulb must be placed to throw a real image of the filament on the wall at the front of the room. The bulb is permanently mounted at this point. A light shield, made from a number 2 tin can with an opening cut in front, is placed over the bulb to prevent it from illuminating the scale.

Ordinary two strand extension cord wire is used to connect the terminals of the galvanometer to an outlet at the demonstration desk. The light switch may also be located here if desired. A row of vertical lines painted on the front wall of the room near the ceiling serves as the galvanometer scale.

With this galvanometer full scale deflection is secured from the current generated by warming the junction points of pieces of copper and nickel-silver wire twisted together.

NSTA Activities

At Boston

December 27-30

The planning committee came up with another good program as NSTA's share in the sixth annual joint conference of the AAAS Science Teaching Societies. Favored by relatively mild weather, some 300 teachers attended the NSTA sessions. About 200 attended the elementary science teaching demonstrations. Other highlights of the conference included three joint sessions and the showing of Roger Tory Peterson's "Bering Sea Adventure" motion pictures.

The NSTA Executive Committee met from 7:30 p.m. to 1:15 a.m. Tuesday evening and took several important actions. (1) They accepted the report of the nominating committee, given in person by chairman Richard H. Lape, and directed that the election be concluded in time to announce the new president-elect at the Chicago convention. (2) They accepted the report of the publications committee, given in person by Abraham Raskin, and authorized "action" on several of the proposals.

Also, (3) they affirmed the following schedule of NSTA meetings for the next year or so: 1954 national convention, Chicago, April 1-3; 1954 summer regional conference (with NEA), New York City, June 28; 1954 fall regional conference, University of Oklahoma Biological Station, Lake Texoma; 1954 winter regional conference (with AAAS), Berkeley, California, Dec. 27-30; 1955 national convention, Cincinnati, Ohio, March 24-26; 1955 summer regional conference (NEA at Chicago), University of Wisconsin, Madison; 1955 winter regional conference (with AAAS), Atlanta, Georgia.

The Executive Committee (4) heard that NSTA income for the first six months of the fiscal year reached 40 per cent of the budget and expenditures 51 per cent. (5) The year-end membership count stood at 6767 members and subscribers, an all-time high. Added encouragement in this figure stemmed from the 78 life members and 674 sustaining members included in the total. A mild "neutralizer" was the fact that at the time of the report, some 1000 members had not yet renewed for 1954.

Members of the Executive Committee at the meeting included president Charlotte L. Grant, president-elect Walter S. Lapp, secretary Zachariah Subarsky, treasurer John S. Richardson, and executive secretary Robert H. Carleton. Past-presidents Nathan A. Neal, Ralph W. Lefler, and Arthur O. Baker and assistant executive secretary John H. Woodburn and a number of NSTA members also attended and participated in the discussions.

The Chicago Convention

April 1-3

The program of events and sessions for the second national convention of NSTA (for *all* teachers of science) has taken definite form and most of the participants have been "signed up." A printed copy of the full program will be mailed to all NSTA members around March 1. The show goes on at the Morrison Hotel, April 1-3. Of interest to many is the fact that the 1954 meeting of the National Association for Research in Science Teaching will be held at the Hotel Sherman in Chicago the three days preceding the NSTA convention. Following is a skeleton outline of the NSTA convention program.

WEDNESDAY, MARCH 31

10:00 a.m. **Advisory Council on Industry-Science Teaching Relations.** This group will continue in session for lunch and through the afternoon

7:30 p.m. **NSTA Executive Committee**

THURSDAY, APRIL 1

Thursday morning is left open for registration, tours, viewing the exhibits, and general "getting acquainted."

9:00 a.m. **Registration** opens ($2.00 to members and non-members)

9:00 a.m. **Exhibits;** open until 6:00 p.m. There will be fifty or more displays of commercial and non-commercial teaching aids for science

9:00 a.m. **Advisory Council**

9:30 a.m. **Tours** (transportation fee for all tours, $1.00)

10:00 a.m. **Business-Industry Section** (The Section will continue in session for lunch and through the afternoon.)

11:00 a.m. **Planning session** for chairmen of panels, symposia, and work-discussion groups

1:30 p.m. **Convention keynote address:** "The Role of Science in General Education"; Harlan Hatcher, President of the University of Michigan

3:00 p.m. **Work-discussion groups;** first session

5:00 p.m. **Film showing:** "Secret Land"; NSTA Motion Picture Committee

8:00 p.m. **Chicago Hospitality Night** (Convention registrants will be guests of the Chicago Business-Industry group.)

FRIDAY, APRIL 2

7:00 a.m. **State Group Breakfasts** (NSTA will help facilitate arrangements for registrants from various states to meet at breakfast if they so desire; contact Miss Dorothy Tryon, Redford High School, Detroit, Mich.)

8:00 a.m. **Registration,** continued

8:00 a.m. **Film showing:** "Rainbow of Stone"

8:00 a.m. **Exhibits;** open until 5 p.m.

9:00 a.m. **Concurrent general sessions**
(1) Elementary science; address: Robert Stollberg, San Francisco State College
(2) Secondary and college; address: Paul B. Sears, Yale University

10:15 a.m. **Elementary science session:** "Using Simple Equipment in the Teaching of Elementary Science"; panel discussion

10:15 a.m. **Concurrent symposia**
(1) "A Look At Science Education Today"
(2) "Encouraging Scientific and Engineering Manpower for the Future"

1:30 p.m. **Elementary science session:** "A Demonstration Teaching Lesson"

1:30 p.m. **"The Scientists Report"** (Several concurrent reports will be given by eminent scientists working in various fields of science.)

1:30 p.m. **Reports of Research in Science Education** (Emphasis will be on the implications for classroom practices.)

2:15 p.m. **"The Scientists Report"** (A second set of concurrent reports will be given at this time.)

3:30 p.m. **Work-discussion groups;** second session

7:00 p.m. **Annual banquet:** address by Detlev Bronk, President of the National Academy of Sciences and President of the Rockefeller Foundation
Presentation of new NSTA President-elect
Presentation of awards to winners in 1954 program of Recognition Awards for Science Teachers
Science?—Or Magic

SATURDAY, APRIL 3

8:00 a.m. **Registration,** continued

8:00 a.m. Film showing: "Progress on Trial"
8:00 a.m. Exhibits; open until 12:00 noon
9:00 a.m. General session
(a) "NSTA, Ten Years of Professional Growth"; a report by the NSTA Executive Secretary
(b) Address by Mrs. Agnes Meyer, Washington, D. C.
10:15 a.m. Concurrent clinic sessions
(1) Elementary School Science
(2) Science in College Programs of General Education
(3) The Laboratory in High School Science
(4) Evaluation in Science Teaching
(5) Facilities for Science Instruction
12:15 p.m. Luncheon; sponsored by Illinois science teacher organizations: guest speakers
2:30 p.m. Concurrent "Here's How I Do It" sessions
(1) Elementary school science
(2) High school and college biological science
(3) High school and college physical science
4:00 p.m. Convention closes
6:00 p.m. First session, program planning committee for NSTA's Third National Convention, Netherland-Plaza Hotel, Cincinnati, Ohio, March 24-26, 1955

A listing of tours and work-discussion group questions has been sent to all NSTA members in Packet XXVII; also a blank for making advance registration for the convention and reservations for tours, the banquet, and the luncheon.

▶ *Committees for Chicago*


Antone A. Geisert

The "housekeeping chores" associated with a national convention of the size and scope of NSTA's require the attention of a very large number of individuals. Through their efforts the convention becomes a highly organized and smoothly operating function. NSTA is indeed grateful to the individuals named in the following list for their participation and assistance being rendered through local committees for the Chicago convention. Special recognition and thanks go to Mr. Antone A. Geisert for his efficient and considerate performance as general chairman of local committees and coordinator of arrangements for the convention.

Audio-Visual Committee

IRA J. PESKIND (*Chairman*), Wright Junior College, Chicago
ROBERT DRUCKER, Columbus Elementary School, Chicago
WILLIAM HEIDMAN, Mozart Elementary School, Chicago
CHARLES W. HILL, Schurz High School, Chicago
FRANK OLSEN, Prussing Elementary School, Chicago

Banquet Committee

NELLY J. BOSMA (*Chairman*), Wright Junior College, Chicago
HOMER BALE, Farragut High School, Chicago
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Roster of Life Members

A reasonable response to Life Membership within an organization may be taken as evidence of confidence and enthusiasm on the part of those to whom the organization's program is directed. The fact that about two per cent of NSTA's individual members today hold such membership is a source of satisfaction and encouragement to the officers and directors of the Association and to all others who share in framing and implementing policies and programs of service. According to office records as of January 22, 1953, the following persons were enrolled as Life Members. It will be appreciated if any errors or corrections are called to the attention of the membership secretary, Miss Frances Keefauver.

Allen, Otis W., Greenwood, Mississippi
Arnold, William J., Tonganoxie, Kansas
Aukerman, W. B., Billings, Montana
Bailey, John H., Johnson City, Tennessee
Barnaby, Catherine, Robertsport, Liberia
Bellamy, Lee R., Mountain View, Wyoming
Bischoff, Harold, Mt. Kisco, New York
Bloom, Samuel W., Rochester, New York
Bostrom, Robert C., Bellingham, Washington
Brandwein, Paul F., Forest Hills, New York
Brown, Stanley B., Boulder, Colorado
Burleson, Charles E., San Francisco, California
Carleton, Robert H., Washington, D. C.
Christianson, Robert, Minneapolis, Minnesota
Conner, William R., Evanston, Illinois
Cram, S. Winston, Emporia, Kansas
De Rose, James, Springfield, Pennsylvania
Derrick, J. Raymond, Wilmington, Delaware
Dowling, Thomas I., Greenwood, South Carolina
Dunning, Gordon, Washington, D. C.
Esposito, William J., Brookfield, Connecticut
Evans, Hubert M., New York City
Farver, Paul H., New Bloomfield, Pennsylvania
Ferris, Duane, Orwell, Ohio
Finch, Elmer A., Amityville, New York
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Neal, Nathan A., East Orange, New Jersey
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Parlato, Vincent, Brooklyn, New York
Parsons, A. Lovell, Gloucester, Massachusetts
Poppe, O. Sherwood, The Dalles, Oregon
Powell, C. F. A., Santa Ana, California

(Please continue on page 47)

FSA Activities

Science Achievement Awards: 1953-54

The Problem: Many students file entry cards and fail to follow through with an actual entry in the Science Student Achievement Awards Contest.

The Analysis: 1. Genuine scientific investigations seldom proceed on schedule.

2. A student project that is truly a venture into the unknown is quite likely to lead the student into blind alleys.

3. Many tentative guesses and approximations don't pan out but do serve to point toward the final fruitful hypothesis.

The Working Hypothesis: The judges in this Awards program would give favorable consideration to student entries that, of necessity, must take the form of a progress report.

The Test: Encourage your students to enter progress reports if their projects are not in finished form by May 15.

Science Teacher Recognition Awards: 1953-54

We are looking forward to the banquet at the Chicago Convention at which the 1954 winners will receive their awards. For those teachers who were not able to make the February 15 deadline, begin now to think of 1955.

Summer Work for Teachers:

Through the efforts of the Foundation, the NSTA is alerting thousands of industrial organizations to the availability during the summer months of a pool of trained manpower—the men and women who teach science in the nation's high schools. We are reminding industrial leaders that these people can fill in nicely during vacation schedules and will certainly appreciate the additional income during the summer months. Most important of all, as one science teacher has put it—"Teachers will value the enrichment of their training that will come from industrial experience and everyone will gain from letting industrial people see the ability and enthusiasm of the members of our profession."

If you know of some key industrial people who should receive the bulletin, send us their names or, if you prefer, we will mail the bulletins directly to you.

Student Chart Making Contest:

Entry coupons have been received from schools in 40 of the 48 states. Apparently, teachers are finding this contest to be a good way to encourage this type of student activity. Remember—all entries are to be mailed directly to the W. M. Welch Scientific Company, 1515 Sedgwick Street, Chicago 10, Illinois before March 1.

Encouraging Future Scientists: Available Materials and Services

This bibliographical inventory provides the information necessary to participate in many incentive programs for science students and teachers. The sources of more than fifty career pamphlets are given. Free copies are being distributed as a phase of our 1954 program.

Science Teaching As a Career:

Our 1954 program includes the preparation and distribution of a career guidance pamphlet that highlights the science teacher and his profession. We need good illustrations of the science teacher at work. A catchy, descriptive, inspiring, and appropriate title would be appreciated. Can you help?

The School Science Laboratory:

Effective laboratory activities have been put on the 1954 program. We are looking for ways to identify those teachers who are exceptionally capable in organizing and conducting laboratory work. Once identified we hope to provide an opportunity to have them get together to pool their experiences and share them with all of us. Any candidates?

Future Scientists of America Foundation, NSTA
1201 16th St., N. W., Washington 6, D. C.

Book Reviews

THE ESCHMEYER SERIES: WOODY WOODCOCK, AL ALLIGATOR, WILLIE WHITETAIL, MAC MALLARD, BOB WHITE. [$.50 each (paper edition.)] Fisherman Press, Inc., Oxford, Ohio. 1952-53.

Dr. Eschmeyer's latest additions to his "True-To-Life Stories" make an excellent contribution to children's literature in conservation education. Each book contains about fifty pages of attractively illustrated material and would probably appeal most to the ten to thirteen age group. Each title takes an animal from the egg, through contacts with natural enemies, sportsmen and game wardens, to maturity.

Al Alligator lives in the Okefenokee swamp refuge where he finds the fish, snakes, and frogs he needs for food. He successfully eludes his bear and raccoon enemies in the early part of his life although several of the young 'gators from the same nest do not escape. Dr. Eschmeyer includes in the story an account of the establishment of the Okefenokee Wildlife Refuge and its recreational and economic values.

Through *Bob White*, the author points up the recreational pleasures of quail hunting and the enjoyment to be derived from rural life by a well-informed farmer with an eye toward intelligent use of the animals in the area. The building of a farm pond is an important aspect of this book.

Marsh management for the proper balance of living things is the theme of *Mac Mallard*. The author also uses the book to clarify legal and illegal duck hunting. Again, natural enemies are eluded in Mac's young life permitting him to reach maturity and be banded by the wildlife conservation people.

Woody Woodcock and *Willie Whitetail* stress similar themes of recreation by the wise use of wildlife resources and the interdependence of living things in any given area. The author also points out the dangers of disturbing the balance of living things. For example, a deer refuge where no hunting is permitted can be a graveyard for scores of deer since there will be too many of them for the amount of food available. The author makes a plea for intelligent use of a deer refuge by permitting limited hunting.

Dr. Eschmeyer brings a rich background to the "True-To-Life Stories" series. He was on the staff of the Michigan Institute of Fisheries Research and in charge of fish work for the TVA. At present, he is vice-president of the Sport Fishing Institute. Each book was checked for scientific accuracy by a recognized authority. As a result, the series contains interesting factual information leading to important concepts about the wise use of wildlife resources. The rich, factual material can be found in few other places by children. Youngsters will surely be interested in the content of each book.

The shortcomings of the series are indeed unfortunate in view of the excellence of the material and its obvious contribution to the literature in the field. The major criticism by this reviewer is the personification of the wild animals as indicated by the title of each book. Although the author is careful to point out that animals don't really think like humans, his titles detract from his efforts in this direction. Since the author does not make extensive use of this personification—he uses it in most cases only for identification—its use is most unfortunate. It mars, somewhat, an otherwise valuable and much needed conservation series for children.

J. MYRON ATKIN
Consultant in Elementary Science
Public Schools, Great Neck, N. Y.

ASTROLOGY AND ALCHEMY—TWO FOSSIL SCIENCES. Mark Graubard. 382 pp. $5.00. Philosophical Library, New York. 1953.

A fossil theory is one which failed to survive when "times, ideas, values, approaches, tools, interpretations, and assumptions changed." While it lasted it served a purpose; new theories, more suitable and acceptable, took its place. Astrology and alchemy, the author tells us, by failing to meet the needs of the changing times, became fossil ideas.

The purpose of this well written volume is to treat alchemy and astrology in a scientific manner. The author has attempted to avoid the usual "treatment with contempt." He seeks to understand the times, the men, and the culture involved. Throughout, he insists on dealing only with data. Rejected

are comparisons, judgments, and preconceived notions. His interest lies with the facts.

The volume ends where many histories of science begin, with the astronomy of Galileo and the chemistry of Lavoisier. It is principally concerned with the earlier history of science. From primitive beginnings of astrology in Babylonia, the author examines his way through the cosmology of Ptolemy, the wavering positions of the church, and the Copernican concept. Alchemy is traced from the craftsmen of Egypt through the work of Paracelsus to the accomplishments of Cavendish and Priestley. It is a fascinating journey.

IRVING KAMIL
Manhattan High School of Aviation Trades
New York, New York

COLLEGE CHEMISTRY—A SYSTEMATIC APPROACH. Harry H. Sisler, Calvin A. Vanderwerf and Arthur W. Davidson. 623 pp. $5.25. The Macmillan Company. New York. 1953.

One of the duties of a high-school chemistry teacher is to keep informed about the sort of a college course that his pupils will meet. One good way to keep informed is to read a college chemistry textbook. The textbook under review is suitable for such professional reading, or for reference by high-school pupils.

The critical high-school teacher will be dismayed by the approach to chemistry in this book. It is almost entirely deductive. The three professors do not build the facts of descriptive chemistry into a cogent background for theory. Instead, they pontificate theory and then relate a fact or two in support of their view. Such typical statements are made as, "Since all the atoms in such crystals are connected by strong covalent bonds, the crystals are very hard, have extremely high melting points, and are non-volatile." (p. 121) Secondary-school teachers are more accustomed to the convincing inductive method in a textbook, such as: "The great hardness, the high melting points, and the non-volatile nature of these crystals are explained by assuming that strong covalent bonds exist between the atoms in the crystals."

Characteristics of this text include: much attention to physical chemistry; much space devoted to derivations of various constants for which very little use is made; relatively brief treatment of organic chemistry; a fairly extended description of the less important elements and their compounds.

The high-school teacher will value this book because of the many pictures of models of compounds and because of its explanations of electron configurations. The descriptions of substances that are beyond the range of the high-school texts are also valuable, especially for projects. Altogether, COLLEGE CHEMISTRY is a useful supplement to the secondary-school teacher's resources.

ELBERT C. WEAVER
Phillips Academy
Andover, Massachusetts

MISS PICKERELL GOES UNDERSEA. Ellen MacGregor, Illus. by Paul Galdone. 128 pp. $2.25. McGraw-Hill Book Company, Inc. New York. 1953.

The peripatetic Miss Pickerell is adventuring again. This time she has gone under the sea in search of her collection of red stones that she gathered on her trip to Mars. Her experiences on a salvage barge, an atomic submarine, and in a skin-diving suit are utterly fantastic though factually correct. Perhaps therein lies the charm of this totally unbelievable character. The reader will be exposed to some facts about science; that sonar sends out pulses, that Diesel submarines need a snorkel, that with a snorkel pressures vary in a submarine, that the first to recover salvage has claim to a sunken ship, that divers must return to the surface slowly, that nitrogen may bubble in the bloodstream of a diver. Refreshing drawings and clear type make for a clean, attractive volume. Children will like to read it, but it is questionable if the book should be classified under science. As one youngster put it, "Miss Pickerell sure is crazy, but I like her."

FRANKLYN M. BRANLEY
Horace Mann School
New York, New York

EXPERIMENTAL ELECTRICITY FOR THE BEGINNER. Leonard R. Crow. 240 pp. The Scientific Book Publishing Company. Vincennes. Indiana.

This book is written to accompany the *Crow Beginner's Experimental Kit in Electricity*. Its purpose is to provide training suitable for apprentice training programs, 4-H Club boys and girls, Boy Scouts, summer camp projects, vocational rehabilitation programs, home study programs in electricity and hobby projects in electricity.

The best evaluation of this book can be told in the language in a paragraph from the preface:

"It is quite true that this book is written on electrical experiments involving the use of a specially designed type of equipment. Were it written in any other manner, its value would be enormously reduced, because the only correct way to study

elementary electricity is by the evolutionary process. Experiments must follow a proper sequence; they must be related. Each experiment should logically evolve from the one preceding it; should be the outgrowth, modification of, or supplement to it. Therefore, it is highly important to have a well planned, correctly designed and properly constructed set of experimental equipment if it is to be expected that the student attain any worthwhile knowledge for his time and efforts."

The physical features of the book are worth mentioning. The paper is non-glaring, the print is large, and the book lies flat at any opening. The diagrams are clear and uncluttered from unecessary details.

In conclusion it can be said this book makes the learning of electricity easy and attractive.

MILLARD H. QUALLS
Mt. Pleasant High School
Mt. Pleasant, Tennessee

ALL ABOUT RADIO AND TELEVISION. Jack Gould. 143 pp. \$1.95. Random House. New York. 1953.

This book is the latest addition to the "All About" book series which Random House is publishing for boys and girls aged 9 to 12. Other books of this series deal with topics such as dinosaurs, the sea, the weather, volcanoes and earthquakes. This book on electronic communications was written by Jack Gould, who has served as radio and television editor of the New York Times for the past nine years.

Youthful readers should have no trouble in understanding the author's explanations of the production of radio and television signals, the transmission of the radio waves, and the reception and conversion of the signal received at home into something which is audible and visible. The explanations are presented in simple, non-technical terms and are accompanied by excellent diagrams and illustrations. Among some of the other topics covered are the operation of vacuum tubes, the principles of color television, television networks, and radar. There is one chapter which gives detailed instructions for constructing a razor blade "foxhole" radio receiver and a crystal receiver.

One criticism which might be made is the author's omission of a chapter containing an elementary treatment of the possible sociological implications of the development of modern electronic communication techniques. Despite this omission the book is excellent and should receive an enthusiastic reception from elementary school children who will enjoy and appreciate the lucid explanations and fine illustrations. Incidentally, it should also be welcomed by many parents and teachers who may have been looking for a book like this to place in the hands of boys and girls who have asked them questions about radio and television which they themselves were unable to answer.

HAROLD S. SPIELMAN
School of Education
City College of New York

WAYS OF MAMMALS IN FACT AND FANCY. Clifford B. Moore. 273 pp. \$3.50. The Ronald Press Company. New York. 1953.

The "Fact and Fancy" in this book are equally fascinating. The author who is the Director of the Forest Park Museum in Springfield, Massachusetts, has drawn upon a vast literature and upon the direct experience of a wide circle of professional students of animal behavior to produce a non-technical, readable and—one might even say—a delectable work. The arrangement of the material is refreshingly informal: 1. Hoofed mammals, 2. Mammals with pouches, 3. Mammals that fly, 4. Flesh-eating mammals, 5. Gnawing mammals, 6. Aquatic mammals, 7. Monkeys, apes and man, and 8. More beliefs about mammals. The latter is a catch-all chapter.

Like every good science teacher, the author frequently steps aside and lets the experts speak for themselves. Thus, he lets H. E. Hill speak about camels, C. G. Hartman about oppossums, G. M. Allen about bats, J. R. Matsin about bears, G. G. Simpson about "the missing link" and F. A. Beach about "hypnotizing animals" and about animal leadership.

This work would be a useful addition to the bookshelf of the biology teacher, the camp nature counsellor, the elementary school science teacher, the

museum curator and others who are called upon to satisfy curiosity about mammals.

Though "popular" in the better sense of that word, the book, here and there, reaches up into some curious corners of the scientist's ivory tower. For example, in commenting on the scientific name of the wolverine, *Gulo luscus,* the author points out that,

> "The species name *luscus* which means 'half blind' has been commonly misinterpreted with the results that the wolverine has acquired a reputation for bad eyesight. In reality, *luscus,* as applied to this mammal by Linnaeus (1766) originated in Sir Hans Sloane's specimen having, through an accident, lost an eye."

Perhaps the mammal most revealed in this work is *Homo sapiens,* himself, who is lately learning to anchor his flights of fancy to facts.

ZACHARIAH SUBARSKY
Bronx High School of Science
New York City

SCIENCE FOR MODERN LIVING—A Series—Book One through Six (Also Seven through Nine for Junior High School) Books One through Three, Victor C. Smith, Katherine Clarke in consultation with W. R. Teeters. Book Four through Six, Victor C. Smith, Barbara Henderson in consultation with W. R. Teeters. J. B. Lippincott Company. 1951.

This very attractive series of books has a Teacher's Manual for every three books. They are divided into book number, unit number, page number with information about the picture, and science principles and related activities for each page. The Manual answers the questions for each unit and would be of great assistance in guiding the teacher and students to get the full value of the series.

The books are written to enrich the experience of the child's environment through direct observation and correct interpretation of it, and at an early age, to develop the ability to observe and to generalize from observation under proper guidance.

The books can be used as supplementary readers in the primary grades and as science books in the intermediate grades. They stimulate a child's interest with pictures, information in story form, and good questions. Color plays an important part in making this series attractive and in giving the pictures a life-like look. Suggested experiments add to the interest of these books, too.

ELEANOR L. O. HASLEM
Wayne Township Schools
Wayne, N. J.

LIFE MEMBERS—continued from page 39

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Clip'n MAIL

These coupons announce the availability of free and low-cost teaching aids for science. Business-sponsored items have been reviewed by the NSTA Evaluation Committee and approved for distribution by the Association. To procure copies of desired items, fill out and clip the corresponding coupons and mail these, together with any remittance required, to the NSTA Executive Secretary, 1201 Sixteenth Street, N.W., Washington 6. Watch these columns for additional offerings in future issues of *The Science Teacher*. (Print or type coupons.)

THE ODYSSEY OF MODERN DRUG RESEARCH. *The Upjohn Company.*

A story of what lies behind the drugs of the present and future. Describes the method and tools of research and production and the elaborate technology of apparently simple preparations. Illustrated in color. 124 pp.; free.

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THE ROMANCE OF NICKEL. *The International Nickel Company, Inc.* A story of nickel—its history, production, use, and future. Revised to include the most recent technological developments in mining and smelting operations. Well illustrated and interesting to read. 65 pp.; free.

CELLULOSE—THE CHEMICAL THAT GROWS. *Doubleday & Company, Inc.*

This first book of the American Industry Series presents the story of one of the world's most important renewable resources. The author, William Haynes, makes scientific facts appear to be fiction. Now being distributed to NSTA life and sustaining members; available to other members while the limited supply lasts. Teacher's Guide included. *Recipients of the book will be expected to make a postal card report of their experiences with the use of the book in their science classes.*

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